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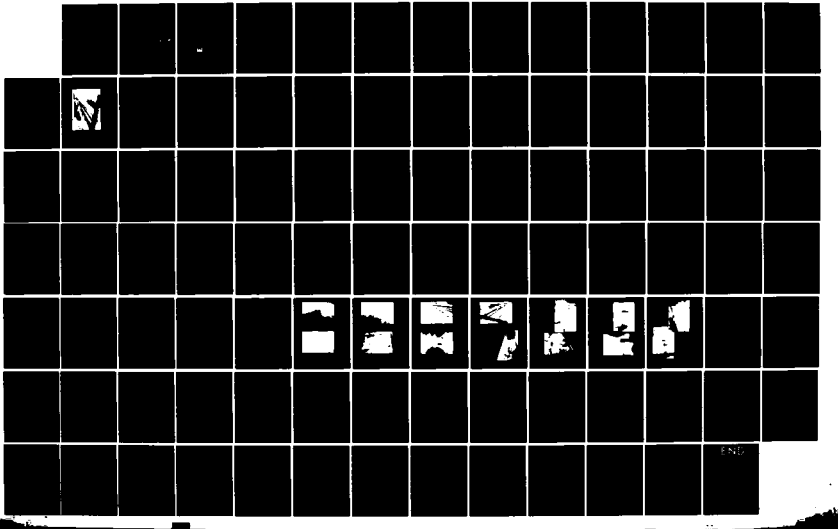

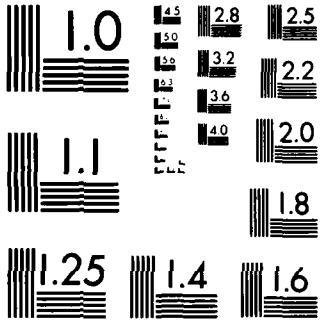

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CONNECTICUT RIVER BASIN

NELSON, NEW HAMPSHIRE

GRANITE LAKE DAM

NH 00336

NHWRB 166.02

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

MAY 1979

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Connecticut River Basin
Nelson, New Hampshire
Granite Lake Brook

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

THe dam is a dry rubble masonry damwith a concrete facing. It is about 78 ft. long with a maximum height of 34 ft. The overall condition of the dam is considered to be fair. At the time of the inspection the penstock opening has been sealed and the intake gate removed. It is intermediate in size with a significant hazardpotential. The test flood would overtop the dam by 2.8 ft. There are various maintenance and operating measures which should be implemented.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO ATTENTION OF:

NEDED

SEP 6 1973

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

I am forwarding to you a copy of the Granite Lake Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, Granite Lake Association, Munsonville, New Hampshire 03457.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely,

Max B. Scheider

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

GRANITE LAKE DAM

NH 00336

NHWRB 166.02

CONNECTICUT RIVER BASIN
NELSON, NEW HAMPSHIRE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.:	NH00336
Name of Dam:	Granite Lake Dam
Town:	Nelson
County and State:	Cheshire, New Hampshire
Stream:	Granite Lake Brook
Date of Inspection:	May 25, 1978

BRIEF ASSESSMENT

Granite Lake Dam, constructed prior to 1935, is a dry rubble masonry dam with a concrete facing. It is approximately 78 feet long with a maximum height of 15 feet above the stream bed. This dam has a top width of approximately 34 feet to accommodate two paved lanes of a local highway. The spillway, located near the center of the dam, is approximately 12 feet long, 2.5 feet below the top of the dam.

Based on visual inspections, available records, and hydraulic/hydrologic evaluation, the overall condition of the dam is considered to be fair. At the time of the inspection, the penstock opening has been sealed and the intake gate removed. The 18-inch corrugated drain pipe was plugged. Continuance of this classification depends on proper operations and maintenance of the dam.

This dam falls under the category of significant hazard potential, and it is intermediate in size. The test flood peak inflow is equal to one-half the Probable Maximum Flood, 3,608 cfs, and the test flood peak outflow is 1067 cfs. Hydraulic analysis indicates a surcharge height of 5.3 feet above the spillway crest. The spillway will pass approximately 13% of the test flood peak outflow without overtopping the dam, and therefore the spillway capacity is seriously inadequate. The test flood would overtop the dam by 2.8 feet.

As stated in Section 7, the upper bridge between Granite Lake and Mill Pond should be repaired. The 18-inch diameter drain pipe should be made operable within one year after receipt of this Phase I report by the owner and within 2 years, the owner, Granite Lake Association, should retain the services of competent engineer and implement the results of his evaluation of the following:

(1) The modification necessary to improve the hydraulic and hydrologic conditions of the dam.

(2) The extent of possible submergence at East Sullivan Village.

The following operating and maintenance measures, as stated in Section 7.3, should also be implemented:

(1) The penstock should be made fully operable.

(2) Proper grade of the downstream shoulder of the roadway should be reestablished, and the upstream slope of the dam should be inspected at low water.

(3) Remove broken dock from approach channel, vegetation from downstream backfill to facilitate future seepage inspection, and debris from downstream channel.

(4) An operating and maintenance manual for the project should be prepared.

(5) A program of technical biannual periodic inspection of the project features shoud be prepared and initiated.

(6) Surveillance and a warning system should be developed for periods of unusually heavy rains and runoff.

FAY, SPOFFORD & THORNDIKE, INC.
By

Jurgis Gimbutas, P.E.
Project Engineer

Richard W. Albrecht, P.E.
Vice President

This Phase I Inspection Report on GRANITE LAKE DAM has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Charles G. Tiersch

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

Fred J. Ravens Jr.

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

Saul Cooper

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in Recommended Guidelines for Safety Inspection of Dams, for a Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineer, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greated reasonable possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

TABLE OF CONTENTS

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

The Granite Lake Association has operated Granite Lake Dam since about 1935. The lake level is maintained by a spillway located at the center of the dam. The flow is controlled by stop logs manually operated. The lake level can not be lowered due to the inoperable pipe drain and penstock.

4.2 Maintenance of Dam

The maintenance of Granite Lake Dam in Munsonville is the responsibility of the Granite Lake Association.

4.3 Maintenance of Operating Facilities

No written maintenance procedures were disclosed for Granite Lake Dam. Maintenance of operating facilities to control the 18-inch diameter corrugated pipe drain in the middle of the dam is non-existent. Similarly, the penstock was plugged a few years ago.

4.4 Description of any Warning System in Effect

There is no flood warning system in effect.

4.5 Evaluation

The current operation and maintenance procedure for Granite Lake Dam are inadequate to insure that all problems can be remdedied within a reasonable period of time.

miles, respectively. The length of the lake shoreline is 3.2 miles. The maximum depth of the lake is 111 feet. The shoreline of Granite Lake is lined with a larger number of trees and there are some cottages scattered around the lake.

The outlet of Granite Lake flows through a stone culvert under a town road and into a mill pond. On the west side as well as on the east side of the abutments of the culvert, there are trees and the revetment was found to be in loose condition. At the time of our inspection, a broken dock floating in the approach channel and apparently obstructing flow through the culvert was noticed (Photographs No. 1, 2 and 3, Appendix C). The outlet of the lake discharges into a mill pond of less than one-half acre in area.

e. Downstream Channel

The downstream channel and side slopes are in good condition. Debris was observed in the channel with small bushes overhanging. The quantity observed will not significantly impede the flow in the channel (Photographs No. 13 and 14, Appendix C).

3.2 Evaluation

The observed condition of the dam is good. The potential problems observed during the visual inspection are listed as follows:

a. Potential for overtopping.

b. Inability to drain the Lake because of the inoperable pipe drain and penstock.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

The Phase I inspection of Granite Lake Dam was performed on May 5, 1978. A copy of the inspection check list is included in Appendix A.

a. General

In general, the soil and rock features are in good condition. The concrete was observed to be in good condition, see subparagraph c.

b. Dam

No evidence of vertical or horizontal misalignment was observed. There is no indication of sloughing, bulging or movement of the slopes, nor is there any evidence of seepage or piping.

On the east side of the dam, approximately 24 feet from the center of bridge, a 1-foot section of the downstream shoulder of the roadway has dropped a maximum of 9 inches. Observations indicate that this was probably caused by erosion (Photograph No. 10, Appendix C).

c. Appurtenant Structures

All concrete above the water line was observed to be in good condition (Photographs No. 7 and 8, Appendix C). The exposed face of the rubble masonry appear to be sound.

At the time of the inspection the penstock opening has been sealed and the intake gate removed. The 18-inch corrugated drain pipe was plugged.

The upper bridge between Granite Lake and Mill Pond was observed to be in fair condition with poor joints. The stone blocks at the abutments were seen to be misaligned.

d. Reservoir Area

Granite Lake is situated at the headwaters of Lake Outlet Brook in the Connecticut River Basin. It is located in Munsonville Village, New Hampshire. There is a roadway around the lake. The area of the lake is 247 acres. The length and width is 1.08 miles and 0.5

b. Adequacy

Sufficient engineering data are available for a Phase I inspection.

c. Validity

The available engineering data is considered valid on the basis of the results of the visual inspection.

SECTION 2 - ENGINEERING DATA

2.1 Design

No original design data was disclosed for Granite Lake Dam.

2.2 Construction

No original data are available on the construction of this dam.

2.3 Operation

No engineering operational data was disclosed. Normal operational procedures are described in Sections 1.2.i and 4.1.

From the questionnaire of the Water Control Commission of the State of New Hampshire, dated October 13, 1938, it is known that the Granite Lake Dam was damaged by the flood of September 21-24, 1938. During this flood, the maximum depth of flow over the permanent crest of the spillway was 4 feet which caused the fill on the downstream side to be washed out.

For information pertaining to history of previous failures or deficiencies, refer to Section 1. In 1974, this dam was reconstructed. Suggestions and recommendations by the New Hampshire Water Resources Board, which were not incorporated in the reconstruction, are listed below:

a. Lower the present spillway crest and install automatic failing flashboards.

b. Make the penstock operable and reinstall the penstock gate.

2.4 Evaluation

a. Availability

Pertinent structural, geotechnical, hydrologic and hydraulic data, which formed the basis of the design of the dam, are not available from the project records. However, structural and geotechnical data are available on a limited basis. The hydraulic and hydrologic determinations for design as collected from project records were obtained by thumb-rule techniques.

(8)	Cutoff	Concrete facing on upstream side prevents water seepage through dam
(9)	Grout curtain	None

h. Spillway

(1)	Type	Ungated concrete weir
(2)	Length of weir	12 feet
(3)	Crest elevation	1279.5 (MSL)
(4)	Gates	None
(5)	U/S channel	Pond

i. Regulating Outlet

(1)	Invert	1271.5 (MSL)
(2)	Size	18 inches diameter
(3)	Description	Corrugated metal pond drain (plugged)
(4)	Control mechanism	Cast-iron flap gate
(5)	Others	
	(a) Description	32-inch steel penstock (opening sealed)
	(b) Invert	1271.2 (estimated)
	(c) Control mechanism	Gate operated (gate removed prior to 1974)

d. Reservoir

(1) Length of maximum pool - 1.3 miles (estimated).

(2) Length of recreation pool - 1.1 miles.

e. Storage (Acre-Feet)

The following values are estimated:

(1) Top of dam - approximately 2734 acre-feet.

(2) At test flood maximum pool Elevation 3330 acre-feet.

(3) Flood control pool - unknown.

(4) Recreation pool - 2204 acre-feet.

(5) At spillway crest - 2204 acre-feet.

f. Reservoir Surface (Acres)

The following values are estimated:

(1) Top of dam - 247 acres.

(2) Maximum test flood elevation pool - 290 acres.

(3) Recreation pool - 212 acres.

(4) Spillway crest - 212 acres.

g. Dam

(1)	Type	Dry rubble masonry
(2)	Length	78 feet
(3)	Height	15 feet
(4)	Top width	34 feet
(5)	Side slopes	Vertical
(6)	Zoning	Not applicable
(7)	Impervious core	Not applicable

b. Discharge at Dam Site

(1) Outlet works (conduits) - A 32-inch diameter old penstock, which is now plugged, and an 18-inch diameter corrugated metal pipe drain with an invert elevation 8 feet below the spillway crest, which is sealed, presently are the two outlet works.

Estimated discharges through the penstock are furnished below:

99 cfs at maximum Pool Elevation 1284.8
87 cfs at top of dam Elevation 1282.0
75 cfs at pond elevation at spillway crest 1279.5

Estimated discharges through the 18-inch diameter drain pipe are furnished below:

32 cfs at maximum Pool Elevation 1284.8
28 cfs at top of dam Elevation 1282.0
24 cfs at normal Pool Elevation 1279.5

(2) Maximum known flood at dam site - flood of September 21-24, 1938, 380 cfs.

(3) Ungated spillway capacity at top of dam - 142 cfs at Elevation 1282.0.

(4) Ungated spillway capacity at test flood main pool - 440 cfs at Elevation 1284.8.

c. Elevation (Feet above MSL)

(1) Top dam - 1282.0.

(2) Maximum pool elevation corresponding to test flood - 1284.8.

(3) Full flood control pool - unknown.

(4) Recreation pool - 1279.5.

(5) Spillway crest - 1279.5.

(6) Stream bed at centerline of dam - 1267.5 (estimated).

(7) Maximum tail water - 1274.1 (estimated).

g. Purpose of Dam

The original purpose of this dam was to store water for power to be used by the mills downstream. Presently, the prime purpose is for recreation.

h. Design and Construction History

Prior to 1935, a dry rubble masonry dam with a concrete facing was constructed at this site. Incorporated in the dam at the time, was a drain in the center of the dam and a 32-inch penstock in the east side of the dam controlled by a manually operated gate. In 1937, the drain in center of the dam was described as a 2-foot by 2-foot opening and, in 1974, described as an 18-inch corrugated metal pipe.

A memorandum concerning an inspection made by the New Hampshire Water Resources Board in September, 1974, states that the penstock opening had been sealed off and the gate to the penstock was removed. Another memorandum, dated October, 1974, states that the face of the dam had been resurfaced and there were no visible signs of the penstock. The New Hampshire Water Resources Board indicates in their memorandum, dated March, 1978, that during the reconstruction of the dam in 1974, the spillway crest was raised by 2 inches. Between 1974 and the time of our inspection, the pond drain had been plugged according to Mr. Joseph Patnode, president of the Granite Lake Association.

i. Normal Operational Procedure

Since the pond drain has been plugged and the penstock opening sealed, there is no control of flow and the water level in the lake cannot be lowered.

1.3 Pertinent Data

a. Drainage Area

Granite Lake, as shown on the U.S.G.S. map, flows through Lake Outlet Brook, approximately 1 mile long, into Otter Brook. This lake is a natural one, but the water surface in the lake is controlled by the lower mill pond dam, namely, Granite Lake Dam. It has a drainage area of 3.7 square miles with its watershed area heavily wooded, undulated and rolling.

b. Description of Dam

The dam consists of dry rubble masonry with a concrete upstream face. It is approximately 78 feet long with a maximum height of 15 feet above the stream bed. This dam has a top width of approximately 34 feet to accommodate two paved lanes of a local highway. Upstream and downstream slopes are vertical (Photographs No. 7 and 9, Appendix C).

The spillway is located near the center of the dam. The spillway crest is approximately 6.5 feet wide and 12 feet long and approximately 2.5 feet below the top of the dam (Photographs No. 7 and 11, Appendix C).

c. Size Classification

The storage capacity at the spillway crest is 1,400 acre-feet which falls in the range 1,000 and 50,000 acre-feet, therefore, the dam is classified as intermediate in size.

d. Hazard Classification

In the event of failure of this dam, Munsonville, a village just downstream of the dam, and East Sullivan Village, which is at a distance of about 3 miles downstream, will be in danger of being flooded and loss of life and damage to property will probably occur. The wave height resulting from dam rupture has been estimated to be 10 feet or two-thirds of the dam height. It is estimated that in the event of the failure of this dam, loss of life may be significant and considerable property damage will occur. Therefore, this dam falls in the category of significant hazard potential.

e. Ownership

Prior to 1935, this dam was owned by Mr. T. L. Macbean, who in turn had bought it from Mr. Demeritt Fisher. Available records indicate that Granite Lake Company owned this dam in 1935. After 1935, the Granite Lake Association obtained ownership of this dam.

f. Operator

Mr. Joseph Patnode, Granite Lake Association, Munsonville, New Hampshire, telephone 603-827-3254.

GRANITE LAKE DAM

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Fay, Spofford & Thorndike, Inc., Engineers, have been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed was issued to Fay, Spofford & Thorndike, Inc., under a letter of May 3, 1978, from Mr. Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW 33-78-C-0308 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

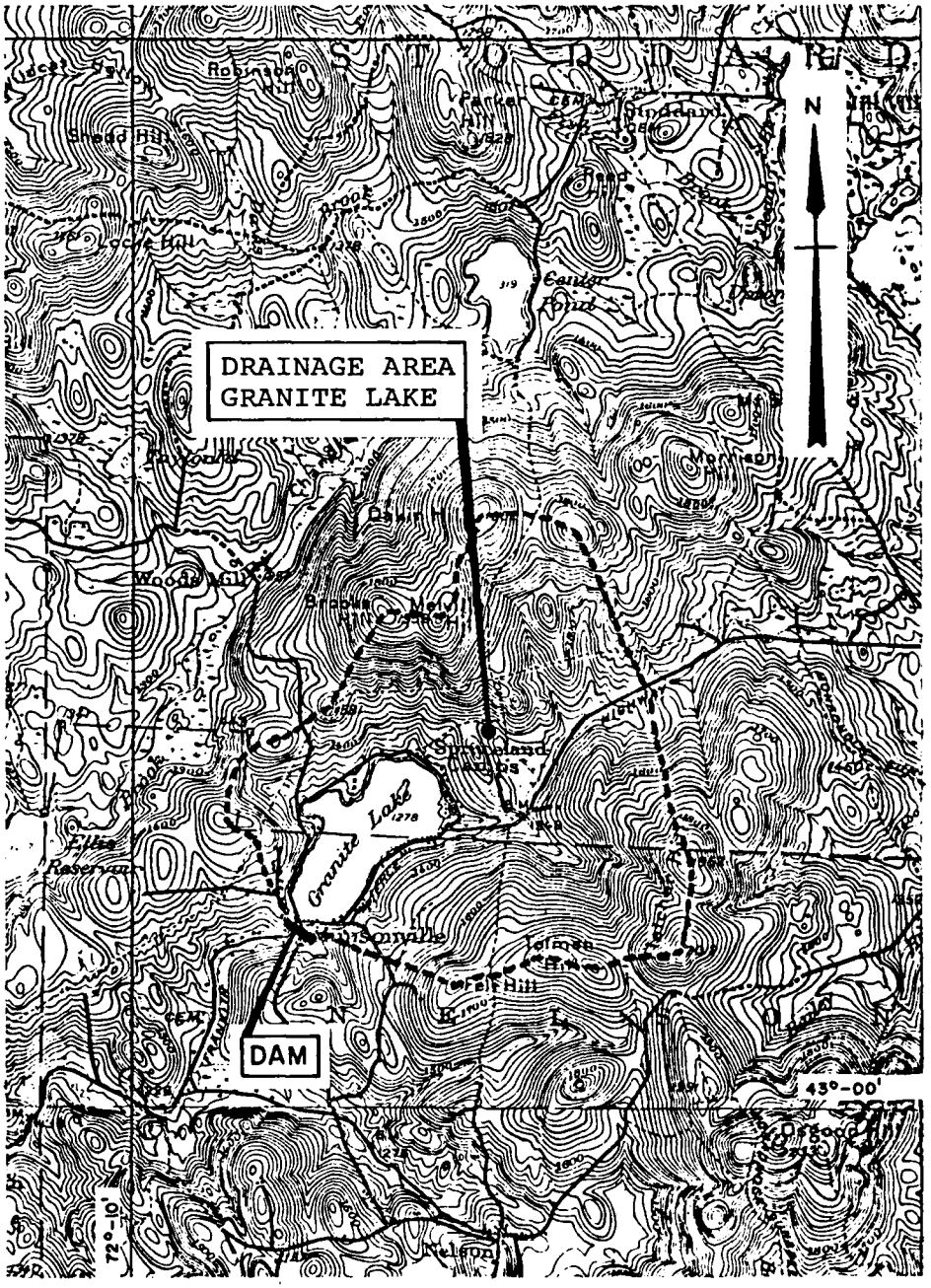
(2) Encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location

Granite Lake Dam is located in southwestern New Hampshire, within the Town of Nelson and the village of Munsonville, about 8 miles northeast of Keene, New Hampshire. This lake flows into Otter Brook in East Sullivan, which is a tributary to the Ashuelot and Connecticut Rivers.



SCALE 1:62500 (ACTUAL)

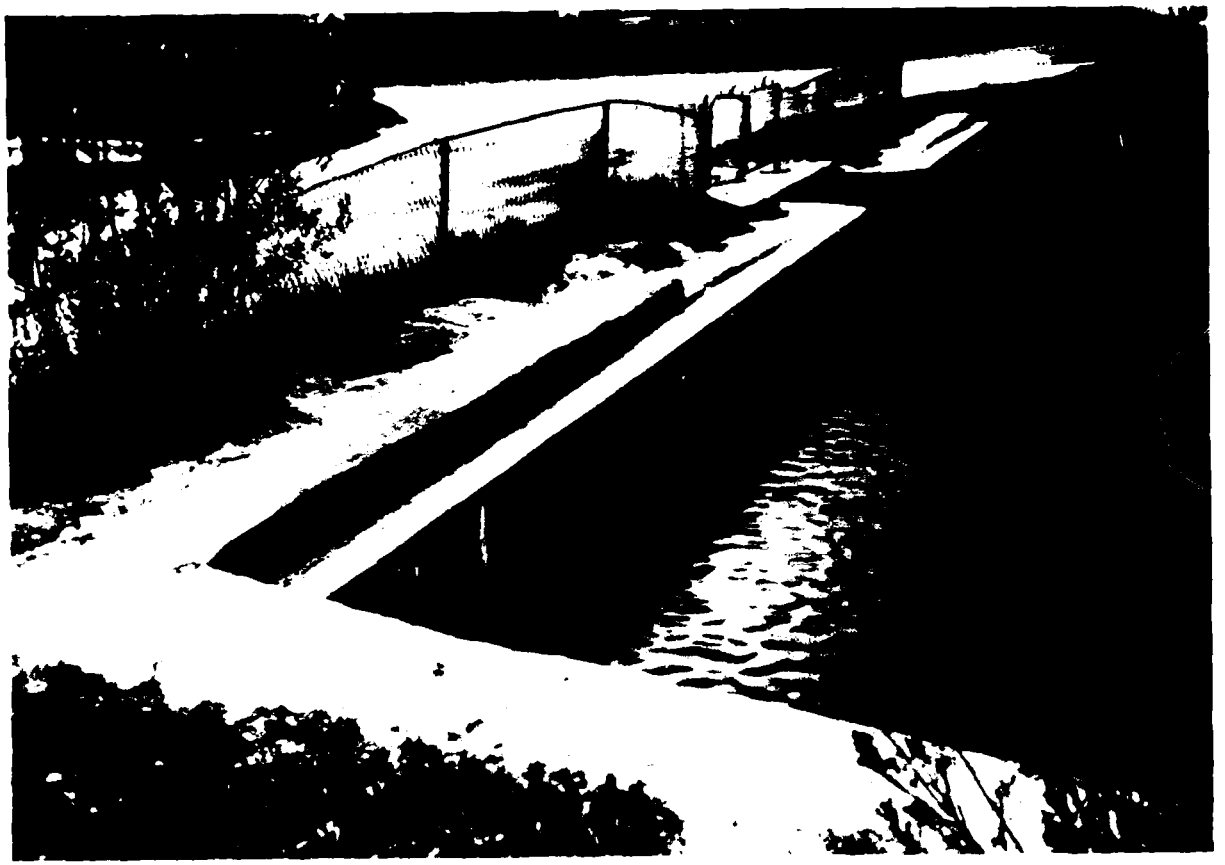
UNITED STATES
DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY

NEW HAMPSHIRE

MONADNOCK QUADRANGLE 1949
AMS 6569 I-SERIES V712

LOVEWELL MOUNTAIN QUADRANGLE 1957
AMS 6570 II-SERIES V712

OVERVIEW PHOTOGRAPH



GRANITE LAKE DAM, LOOKING WEST
Negative No. 2-25

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

(1) This dam falls under the category of significant hazard potential, and it is intermediate in size. Using the "Recommended Guidelines for Safety Inspection of Dams," the recommended spillway test flood peak inflow is equal to one-half the probable maximum flood. The spillway test flood peak inflow was determined to be 3608 cfs. Refer to Appendix D for details. The spillway test flood inflow hydrograph is furnished in Appendix D.

(2) The estimated peak outflow is about 1067 cfs as a result of routing the spillway test flood inflow through the lake by an approximate method. Refer to Appendix D for details.

(3) The lake storage capacity versus the elevation, an estimated capacity curve is included in Appendix D.

(4) The (estimated composite) discharge rating curve for the spillway and dam for pool levels above top of dam (assuming dam remains intact) is furnished in Appendix D.

(5) The hydrologic map of watershed above dam site, including reservoir area, water course, is included in Appendix D.

b. Experience Data

Rainfall records available for the years 1892 to 1941 indicate a high monthly rainfall of 12.43 inches in September 1938. Rainfall in September 1938 exceeded the average for that month by 3.5. The flood of 1938 is considered to be the maximum flood that has occurred. On the basis of regional frequency studies, the flood of 1938 would correspond to approximately a 100-year flood.

c. Visual Observations

The valley cross section immediately below the dam is sufficiently wide to convey the peak outflow from the reservoir which is approximately 1067 cfs. The valley cross section of the downstream

channel at significant impact area: namely, the village of East Sullivan Village, which is about 3 miles downstream of the reservoir, is not sufficient to carry this peak outflow.

d. Overtopping Potential

The spillway test flood peak inflow for Granite Lake Dam is 3608 cfs and the test flood peak outflow is 1067 cfs. Assuming the dam remains intact after being overtopped, the maximum pool elevation is estimated to be 1284.8 and the corresponding surcharge height is estimated to be equal to 5.3 feet above the crest of the spillway. The spillway can pass only about 13% of the test flood peak outflow without overtopping the dam, and therefore, the spillway capacity is inadequate. The test flood would overtop the dam by 2.8 feet. Refer to Appendix D for details.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The upstream slope could not be seen due to the fact that it was underwater. The slope do not show any erosion or weakness. The visual inspection of the dam did not reveal any evidence of instability.

b. Design and Construction Data

There are no construction drawings and structural computations. There are free-hand sketches, made by the inspecting engineer in 1937, showing basic dimensions of the dam.

c. Operating Records

Except for memorandums and correspondence listed in Appendix B, other operating records were not available at the office of the New Hampshire Water Resources Board.

d. Post-Construction Changes

Routine repairs recorded in the files were done in 1953 and 1972. Major work in 1974 included concrete facing on the upstream side and repairs to the plug and to the gate in the dam. They did not affect the structural stability of the dam.

e. Seismic Stability

The dam is located in Seismic Zone 2 and in accordance with recommended Phase I guidelines does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS, & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

The visual inspection indicates that the Granite Lake Dam is in good condition. Based on hydraulic/hydrologic evaluation this dam is judged to be in fair condition. Therefore the overall condition of the dam is fair.

b. Adequacy of Information

An adequate assessment of the dam consistent with the scope of a Phase I investigation has been made based upon the visual inspection and available information.

c. Urgency

The 18-inch diameter drain pipe should be made operable within one year of receipt of the Phase I report by the owner in order to permit lowering of the lake in anticipation of floods and spring runoff. All other remedial measures and recommendations enumerated below should be implemented within 2 years.

d. Need for Additional Investigation

The information available from the visual inspection is adequate to identify the potential problem of overtopping. This problem will require the attention of a competent engineer who will have to make additional engineering studies to design or specify remedial measures to rectify the problem. If left unattended, the problem could lead to instability of the structure.

7.2 Recommendations

a. It is recommended that the Granite Lake Association retain the services of a competent engineer to do the following:

(1) As the spillway discharge capacity is approximately 13 per cent of the test flood peak outflow without overtopping the dam, investigations should be undertaken to explore the feasibility of providing an emergency spillway and/or increase the length of the spillway at a lowered spillway crest elevation.

(2) In view of the inadequacy of the spillway capacity and the probability of overtopping the dam, it is considered advisable that detailed studies should be conducted. These studies should evaluate the probable extent of damage, in the event of failure of the dam, to life and property in East Sullivan, which is about 3 miles downstream of the dam.

(3) Investigations should be undertaken to determine the need to make alterations in the size of the stone culvert across the outlet of Granite Lake to handle the test flood.

b. It is recommended that the upper bridge between Granite Lake and the Mill Pond be repaired.

7.3 Remedial Measures

Although the dam is generally maintained in good condition, it is considered important that the following operating and maintenance procedures be attended to as early as practical:

a. The 18-inch diameter corrugated metal drain pipe should be made operable. The penstock gate should be reinstalled and the penstock made fully operable.

b. Proper grade of the downstream shoulder of the roadway should be reestablished.

c. Upstream slope of dam should be inspected at low water.

d. Remove broken dock from approach channel, vegetation from downstream backfill to facilitate future seepage inspection, and debris from downstream channel.

e. An operating and maintenance manual for the project should be prepared.

f. A program of technical annual periodic inspection of the project features should be prepared and initiated.

g. Because of the location of the dam and the items of concern, round-the-clock surveillance should be provided during periods of high precipitation.

h. The owner should develop a formal warning system. An operational procedure to follow in the event of an emergency should also be adopted.

7.4 Alternatives

None recommended.

APPENDIX A

VISUAL INSPECTION CHECK LISTS

APPENDIX A

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Granite Lake Dam DATE May 25,1978

TIME 1030 - 1530

WEATHER Cloudy - Drizzle

W.S. ELEV. 1279.8 U.S. DN.S.

PARTY:

1. Jurgis Gimbutas, P.E.	Team Captain - Structural and Concrete
2. Harvey H. Stoller, P.E.	Soils, Geology and Foundations
3. V. Rao Maddineni, P.E.	Hydraulics and Hydrology
4.	
5.	

PROJECT FEATURE	INSPECTED BY	REMARKS
1. Dam Embankments	H. H. Stoller	Good
2. Outlet Conduit	J. Gimbutas	Good
3. Outlet Channel Within the Dam	J. Gimbutas	Good
4. Spillway Weir	J. Gimbutas	Good
5. Approach and Discharge Channels	V. R. Maddineni H. H. Stoller	Good
6. Approach Channel Between Granite Lake and Mill Pond	J. Gimbutas	Fair
7. Pond and Downstream Channel	V. R. Maddineni	Good

PERIODIC INSPECTION CHECK LIST

PROJECT Granite Lake Dam DATE May 25, 1978

PROJECT FEATURE Dam Embankment

DISCIPLINE Soils & Foundation NAME [illegible]

PROJECT FEATURE

DISCIPLINE NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	1282.0 M.S.L.
Current Pool Elevation	1279.8 M.S.L.
Maximum Impoundment to Date	1283.5 M.S.L. (1934)
Surface Cracks	Minor surface cracks
Pavement Condition	Fair to good
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	No visual vertical misalignment observed
Horizontal Alignment	No visual horizontal misalignment observed
Condition at Abutment and at Concrete Structures	Good

PERIODIC INSPECTION CHECK LIST

PROJECT Granite Lake Dam DATE May 25, 1978

PROJECT FEATURE Dam Embankment

DISCIPLINE Soils & Foundation NAME [signature]

PROJECT FEATURE _____

DISCIPLINE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
Indications of Movement of Structural Items on Slopes	None observed
Trespassing on Slopes	Vegetation and debris on downstream backfill against the dam
Sloughing or Erosion of Slopes or Abutments	None observed
Rock Slope Protection - Riprap Failures	None observed
Unusual Movement or Cracking at or Near Toes	None observed
Unusual Embankment or Downstream Seepage	None observed
Piping or Boils	None observed
Foundation Drainage Features	None
Toe Drains	None
Instrumentation System	None

PERIODIC INSPECTION CHECK LIST

PROJECT Granite Lake Dam DATE May 25, 1978

PROJECT FEATURE Outlet Conduit

DISCIPLINE Structures NAME [illegible]

PROJECT FEATURE _____

DISCIPLINE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - CONDUIT	
Size	18-inch drain corrugated metal
General Condition	Could not be observed
Erosion or Cavitation	Could not be observed
Gates	Not operable

PERIODIC INSPECTION CHECK LIST

PROJECT Granite Lake Dam DATE May 25, 1978

PROJECT FEATURE Outlet Channel Within Dam

DISCIPLINE Structures NAME [signature]

PROJECT FEATURE _____

DISCIPLINE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET CHANNEL (Within the Width of the Dam)	
General Condition of Stone Work	Good
Erosion or Cavitation	None observed
Condition at Joints	Good

PERIODIC INSPECTION CHECK LIST

PROJECT Granite Lake Dam DATE May 25, 1978

PROJECT FEATURE Spillway Weir

DISCIPLINE Structures NAME [illegible]

PROJECT FEATURE Approach Channel

DISCIPLINE Hydraulics & Hydrology NAME [illegible]

DISCIPLINE Soils & Foundation NAME [illegible]

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel (Mill Pond)	
General Condition	Good
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	None observed
Floor of Approach Channel	Floor not visible through water
b. Spillway Weir	
General Condition of Concrete	Good
Rust or Staining	None
Spalling	None

PERIODIC INSPECTION CHECK LIST

PROJECT Granite Lake Dam DATE May 25, 1978

PROJECT FEATURE Spillway Weir

DISCIPLINE Structures NAME [illegible]

PROJECT FEATURE Discharge Channel

DISCIPLINE Soils & Foundation NAME [illegible]

DISCIPLINE Hydraulics & Hydrology NAME [illegible]

AREA EVALUATED	CONDITION
Any Visible Reinforcing	None
Any Seepage or Efflorescence	None observed
Drain Holes	None observed
c. Discharge Channel (Brook)	
General Condition	Good
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	Small bushes in places
Floor of Channel	Good
Other Obstructions	Debris in channel

M E M O

Vernon A. Knowlton
Chief Engineer

DATE: March 31, 1978

Gary Kerr
Water Resources Engineer

CT: Granite Lake - High Lake Level Complaint

of Inspection: March 30, 1978

DAM: A. All Boards removed, through one is nearby
B. Spillway is all clear (See Photos)
C. Water level is +0.4' overcrest

UPSTREAM CULVERT: A. 4' wd. X 8' dp. with additional 2½' to road
B. Broken dock is sitting on upstream side of stone and concrete culvert
C. A small pile of stones does exist upstream of the culvert and jutts into the lake. It does not however block the main channel flow to culvert. The pile of stones is approximately one foot in height. (above lake bottom)

s. Grace Bell (Phone # 847-9072) called to complain about the "high water" l of Granite Lake. She strongly feels there are two causes, namely (1). oken dock and (2) A line of stones on the upstream side of the culvert h is just upstream of the dam. She feels that these are abstructing the et sufficiently enough to cause the lake to be higher than "normal" and efore to cause ice damage to her family's dock.

ng my investigation it was reported to me that the broken dock (see photos) ngs to a Mr. Lyons who is currently out of state on vacation. However, as been contacted recently by Joe Patenaude, President of the Granite Association (dam owner) and thus far refuses to remove the dock to clear access for flow through the culvert. In my estimation though, this dock ot currently overly limiting the flow. The line of stones previously ioned were reportedly (Mr. Bell) placed there 5 years ago to show a erty line. They stop short of the main discharge channel and therefore e only a minimal obstruction in the flow to the culver. In my opinion, e are not the primary cause of the "high" lake level.

he middle 1970's the dam was reconstructed and the outlet was modified. nvestigation indicates that the spillway crest evelvation may have been ed and this I feel is the real cause of the higher winter lake levels. would also explain, in part, the high water complaint of last fall.

ng my interview of Mr. & Mrs. Bell, I indicated that a possible long term tion would be to petition the Board for a lake level investigation under 454. They said that having 10 lakeside owners sign the petition would be ardship. With that final note I headed for a lake reading of Nubanusit Lake elson.

M E M O R A N D U M

DATE: November 20, 1974

FROM: Stephen C. Burritt, Civil Engineer

SUBJECT: Granite Lake, Nelson - #166.02 (Repairs)

TO: Vernon A. Knowlton,
Chief Water Resources Engineer

On November 7, 1974, I inspected Granite Lake dam, where I found a contractor working on refacing the dam. At this time there was no sign of the old penstock, and the contractor said that the only area to have any discharge other than the spillway was a CMP at the base of the dam.

On November 18, 1974, I revisited the dam to find all the concrete work on the upstream face completed. There was no sign of the penstock, and the 18 CMP was open.

As per the letter from Mr. McGee dated October 7, 1974, the cracks have been permanently sealed. The penstock was not reopened, nor was the spillway crest lowered.

scb/js

M E M O R A N D U M

DATE: September 13, 1974

FROM: Francis C. Moore, Civil Engineer

SUBJECT: Granite Lake Dam, Nelson - #166.02

TO: Vernon A. Knowlton, Chief Water Resources Engineer

On September 10, 1974, I inspected Granite Lake dam in Munsonville at the request of the Granite Lake Association. Three Association members accompanied me: President George E. Zahos, Victor Flanders of Dam Committee and a Mr. Hopkins. The mill pond below the upper road bridge was drawn down four feet below the 12 foot wide spillway by removing the cast iron flap gate in front of the 18" corrugated metal pond drain which invert is located 8 feet below the spillway crest. The upper road bridge had stop logs across the bridge opening with a fish screen on top. (There was considerable leakage around stop logs.)

The spillway is only 12 feet wide, two and one-half feet high, broad crested, and will pass only 158 cubic feet per second. I propose that the spillway be lowered two feet with flashboards failing with 18" head. (Need 4-1" std. pipe pins - 3' on centers and 1 1/2' from ends.) Upon failure, this would pass 382 cubic feet per second at 4 1/2' over flat crested spillway.

15-Year frequency flood flow is 704 cfs.
100-Year frequency flood flow is 1367 cfs.

If the dam is repaired to reduce leakage, there should be an average 12" reinforced concrete facing be placed on the dam. (38 cubic yards of Class A Concrete using 920# reinforcing steel and 400# of Anchor Dowels between new and old concrete. Also, the 18" corrugated concrete pipe drain must have a gate or plug installed. The old penstock opening to the mill downstream is now plugged, but I believe leaks badly. This should be reopened and made operative at times of high flow, although the penstock passes through land of other than the dam owners. The size and location of pipe is not definite. The penstock may be 2 1/2' diameter. In case it is, it might pass 70 cfs. at full pond during floods.

As noted in potential flood flows and capacities of the enlarged spillway and reopened penstock, the peak flow would be only 64% of an average 15-year frequency flood flow. This indicates that some U-shaped spillway similar in shape and size to that at Lovell Lake is needed. The drainage area, pondage and slopes are quite similar to that at Lovell Lake.

If Granite Lake Association enlarges that spillway and reopens the mill penstock, the capacity to pass floods will increase nearly 200%.

fcm/js

MEMORANDUM

December 14, 1962

RE: Investigation of Complaint at Granite Lake, Nelson, N.H.

A field trip to Granite Lake in Nelson, N.H. on December 12, 1962 was conducted to determine the conditions that caused the complaint made by Mr. William Sherrord on December 6. The water level at the time of this field trip was so high as to make a thorough investigation impossible. However, the following conditions were found at the site:

The outlet of Granite Lake flows in a dug channel that flows through a stone culvert under a town road. The upstream side of this culvert has a fish screen 4' wide by 8' deep. However, this screen was lying on the bank of the channel.

From this culvert the outlet flows into a small mill pond whose dam controls the lake level. This dam is a drop culvert section under another town roadway. At one time, a penstock led from this dam to a former mill. However, this penstock has since been removed.

On a sketch of the dam on file, there is shown a 2' X 2' pond drain below the crest of this spillway. At this location, 2 planks protruded from the water surface indicating that this drain had been opened and a temporary closure made.

Conclusions: It appears that this drain had been removed to lower the lake level to accomplish the work (stated on a prior report) and that this drain has been closed. The fish screen may have been removed to allow better flow conditions to this drain. However, it was never replaced. It is my opinion that when the mill pond is drained, the main lake would show only slight loss of water level thereby being the reason of the conflicting reports of total drawdown.

Vernon A. Knowlton
Civil Engineer

Granite Lake 166.02 Aug 5, 1947

The main dam at Granite Lake is in good condition. There is a town road culvert a short distance above the main dam which furnishes a constriction in the outlet channel. There is a fish screen installed on the pond side of the culvert. The fish screen is clogged to a considerable extent with silt and there is considerable silt in the channel above the culvert which should be removed.

The owner of the dam is listed as Edward McBain, Nyack. But as the fish screen is the cause of the trouble, the Fish and Game Dept may be able to arrange for cleaning of the screen.

NEW HAMPSHIRE WATER CONTROL COMMISSION

DATA ON RESERVOIRS & PONDS IN NEW HAMPSHIRE

LOCATION AT DAM NO. 165.02

Town Nelson : County Cheshire

Stream Granite Lake

Basin—Primary Connecticut : Secondary Otter Brk. Ashuelot R.

Local Name

DRAINAGE AREA

Controlled ..... Sq. Mi. : Uncontrolled ..... Sq. Mi. : Total ~~4.5~~ 3.75 CBA Sq. Mi.

ELEVATION vs. WATER SURFACE AREA vs. VOLUME

Point	Head Feet	Surface Area Acres	Volume Acre Ft.
(1) Max. Flood Height			
(2) Top of Flashboards			
(3) Permanent Crest			
(4) Normal Drawdown		211.8	
(5) Max. Drawdown			
(6) Original Pond			

Base Used ..... : Coef. to change to U.S.G.S. Base

RESERVOIR CAPACITY

	Total Volume	Useable Volume
Drawdown	ft.	ft.
Volume	ac. ft.	ac. ft.
Acre ft. per sq. mi.		
Inches per sq. mi.		

USE OF WATER Power for Cotton Mill Chair Factory

OWNER Leonard McBean ~ Granite Lake Association

REMARKS Condition good mill idle

Tabulation By Date April 11, 1939

NEW HAMPSHIRE WATER CONTROL COMMISSION
DATA ON DAMS IN NEW HAMPSHIRE

:ATION — STATE NO. 133.02

own: Nelson Munsonville : County: Cheshire
ream: Granite Lake
asin-Primary: Connecticut : Secondary: Otter Brook Ashuelot R.
ocal Name:
oordinates—Lat. 43° 01' + 5300 : Long. 72° 10' − 5000

NERAL DATA
rainage area: Controlled ...... Sq. Mi.: Uncontrolled ...... Sq. Mi.: Total ~~4.2?~~ 3.75 Sq. Mi.
verall length of dam 120 ft.: Date of Construction
leight: Stream bed to highest elev. 14.5 ft.: Max. Structure 12 ft.
ost—Dam : Reservoir

SCRIPTION: Stone concrete faced up stream
Vaste Gates: Road over dam.

Type
Number 1 : Size 2.5' ft. high x 2.5" ft. wide
Elevation Invert 11' : Total Area 6.25 sq. ft.
Hoist

Waste Gates Conduit
Number : Materials
Size ft.: Length ft.: Area sq. ft.

Embankment
Type
Height—Max. ft.: Min. ft.
Top—Width : Elev. ft.
Slopes—Upstream on : Downstream on
Length—Right of Spillway : Left of Spillway

Spillway
Materials of Construction
Length—Total 12 ft.: Net ft.
Height of permanent section—Max. 12' ft.: Min. ft.
Flashboards—Type : Height ft.
Elevation—Permanent Crest : Top of Flashboard
Flood Capacity 135 cfs.: cfs/sq. mi.

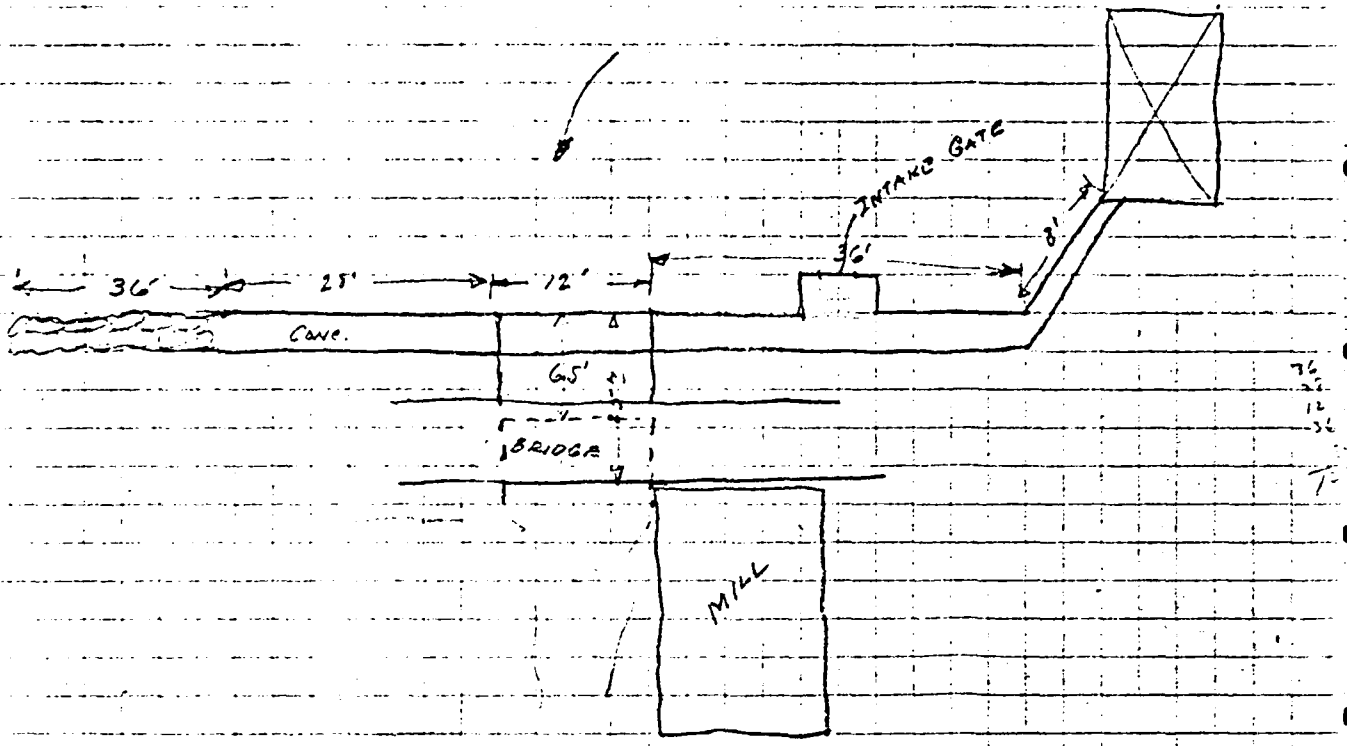
Abutments
Materials:
Freeboard: Max. 2.5 ft.: Min. ft.

Headworks to Power Devel.—(See "Data on Power Development")
WNER: ~~[illegible]~~ N.Y. City / Granite Lake Assn. — GRANITE LAKE ASSOCIATION

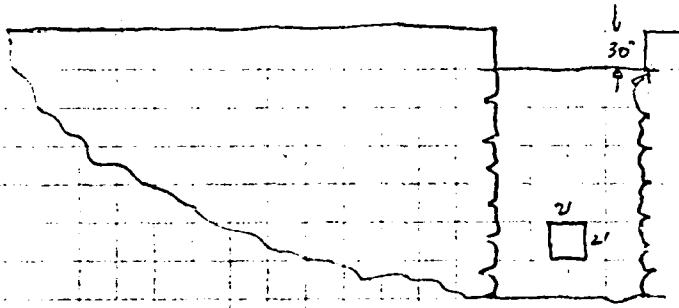
EMARKS: Condition good — B-5
Power for cotton mill and chair factory

abulation By: CGW — Date: April 11, 1939

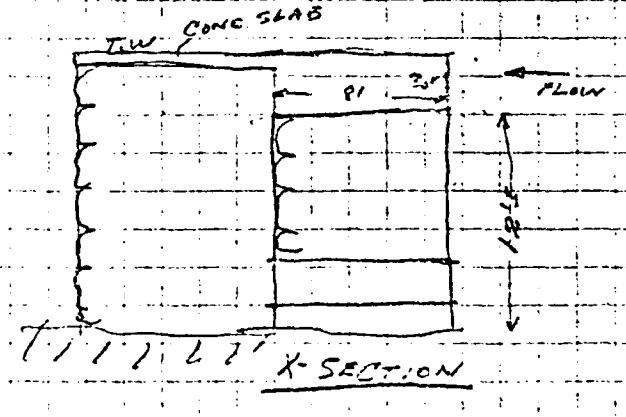
GRANITE LAKE OUTLET DAM - MUNSONVILLE 9/29/37



PLAN



PROFILE



NEW HAMPSHIRE WATER RESOURCES BOARD

INVENTORY OF DAMS AND WATER POWER DEVELOPMENTS

DAM

BASIN Connecticut No. 166.02
RIVER [illegible] MILES FROM MOUTH 2.0 D.A.SQ.MI 4.5
TOWN [illegible] OWNER [illegible]
LOCAL NAME OF DAM
BUILT DESCRIPTION Stone concrete [illegible]
Road over dam.

POND AREA-ACRES 21/.8 P3 DRAWDOWN FT. POND CAPACITY-ACRE FT.
HEIGHT-TOP TO BED OF STREAM-FT. 14.5 MAX. MIN.
OVERALL LENGTH OF DAM-FT. 120 MAX.FLOOD HEIGHT ABOVE CREST-FT.
PERMANENT CREST ELEV.U.S.G.S. LOCAL GAGE
TAILWATER ELEV.U.S.G.S. LOCAL GAGE
SPILLWAY LENGTHS-FT. 12 FREEBOARD-FT. 2.5
FLASHBOARDS-TYPE,HEIGHT ABOVE CREST 2.5

WASTE GATES-NO.	WIDTH	MAX.OPENING	DEPTH SILL BELOW CREST
1	2.5	2.5	11 cementing
1			

REMARKS Condition good
3T [illegible] Road [illegible] Asphalt [illegible]
[illegible]

POWER DEVELOPMENT

UNITS NO.	RATED HP	HEAD FEET	C.F.S. FULL GATE	KW	MAKE
		18-20			

USE Power for cotton mill, chair factory.

REMARKS [illegible] wheel 1932 [illegible]
[illegible]
[illegible] contents of
mill and reserve [illegible] water rights.

DATE 1/29/37 1937

[illegible]

(8) October, 1977, to April , 1978. Several memorandums and letters regarding the high water level at Granite Lake and means of how to reduce possible flood damage.

(9) March 31, 1978. Unsigned free-hand sketch showing a detail of the new concrete facing.

2. Copies of Past Inspection Reports

Included with this report are:

(1) September 29, 1937, by New Hampshire Water Resources Board, with sketches, two pages.

(2) April 11, 1939, data by New Hampshire Water Control Commission, two pages.

(3) August 5, 1947, unsigned, handwritten, one page.

(4) December 14, 1962, by Mr. Vernon A. Knowlton, New Hampshire Water Resources Board, one page memorandum.

(5) September 13, 1974, by Mr. Francis C. Moore, Civil Engineer, New Hampshire Water Resources Board, one page.

(6) November 20, 1974, by Mr. Stephen C. Burritt, Civil Engineer, New Hampshire Water Resources Board, one-half page.

(7) March 31, 1978, by Mr. Garry Kerr, Water Resources Engineer, New Hampshire Water Resources Board, one page.

Also included with this report is a reduced copy of a map of Granite Lake, done by Mr. William McIntire in 1946. It shows the depth of water and houses around the lake. There is a later edition of same map, dated 1975, on sale at the Munsonville Country Store. However, this later edition does not have depth contours, just depth measured.

APPENDIX B

1. Listing of Records and their Location

The New Hampshire Water Resources Board in Concord, New Hampshire, 37 Pleasant Street, have a file of records and correspondence, 1935 to 1978, filed under Town/Dam No. 166.02.

The documents of importance to design and maintenance are the following:

(1) September 26, 1935. Memorandum regarding sand bags at the outlet of Granite Lake by telephone from Mr. Blodgett of the Granite Lake Company of Munsonville.

(2) October 1, 1935. Letter from Mr. Samuel J. Lord, Hydraulic Engineer, to the Public Service Commission, regarding his inspection of Granite Lake outlet on September 26, 1935. There are some calculations, descriptions and photographs originated by this inspection, but no formal report.

(3) October 13, 1938. Questionnaire regarding damage done by the flood of September 21-24. The fill back of dam was washed out.

(4) December 7, 11, and 14, 1962. Memorandums by Mr. Vernon A. Knowlton, regarding complaints about the high water level.

(5) November 21, 1972. Letter from Mr. G. M. McGee, Sr., Chairman, New Hampshire Water Resources Board, to Mr. G. E. Jahos, president, Granite Lake Association. Warning about possible damages if the gate plug should be pulled.

(6) May 2, 1974. Several photographs, made in connection with the Army Corps of Engineers Dam Inventory Program. No report or inventory sheet attached.

(7) December 26, 1974. Letter from Mr. G. M. McGee, Sr., Chairman, New Hampshire Water Resources Board to Mr. V. Flanders, Granite Lake Association. Stating that the recently made repairs were inadequate and requesting to make the gate operational. Some other correspondence regarding same repairs.

APPENDIX B

EXISTING AVAILABLE INFORMATION

PERIODIC INSPECTION CHECK LIST

PROJECT Granite Lake Dam DATE May 25, 1978

PROJECT FEATURE Approach Channel Between Granite Lake and Mill Pond

DISCIPLINE Structures NAME [illegible]

PROJECT FEATURE _____

DISCIPLINE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
Rusting or Corrosion of Steel	None
b. Mechanical and Electrical	None

PERIODIC INSPECTION CHECK LIST

PROJECT Granite Lake Dam DATE May 25, 1978

PROJECT FEATURE Approach Channel Between Granite Lake and Mill Pond

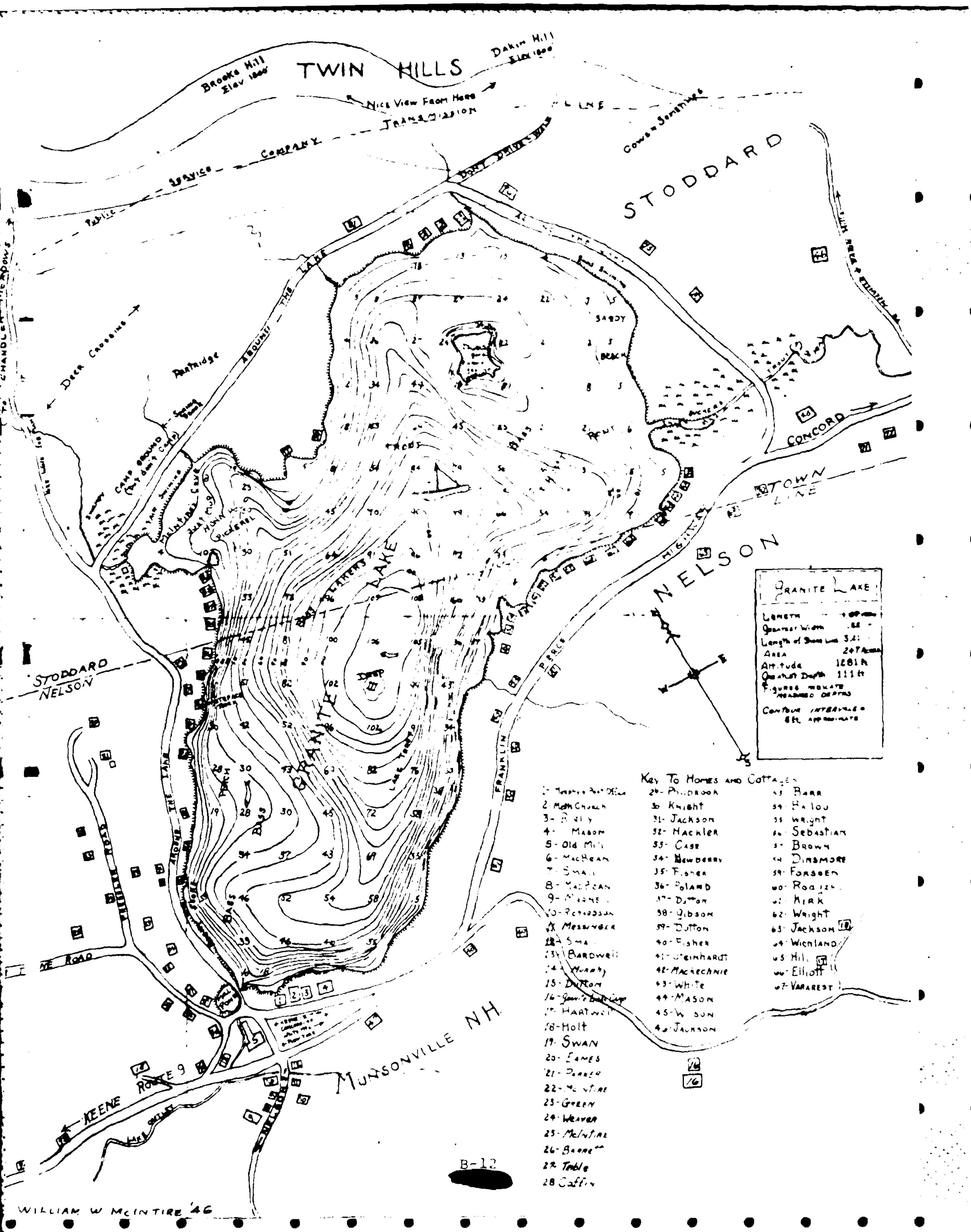
DISCIPLINE Structures NAME [illegible]

PROJECT FEATURE _____

DISCIPLINE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - APPROACH CHANNEL BETWEEN GRANITE LAKE AND MILL POND	
a. Concrete and Structural (Bridge Over Channel)	
General Condition	Fair
Condition of Joints	Poor
Spalling	None
Visible Reinforcing	None
Rusting or Staining of Concrete	None
Any Seepage or Effloresence	None
Joint Alignment	Stone blocks at abutments misaligned
Cracks	None

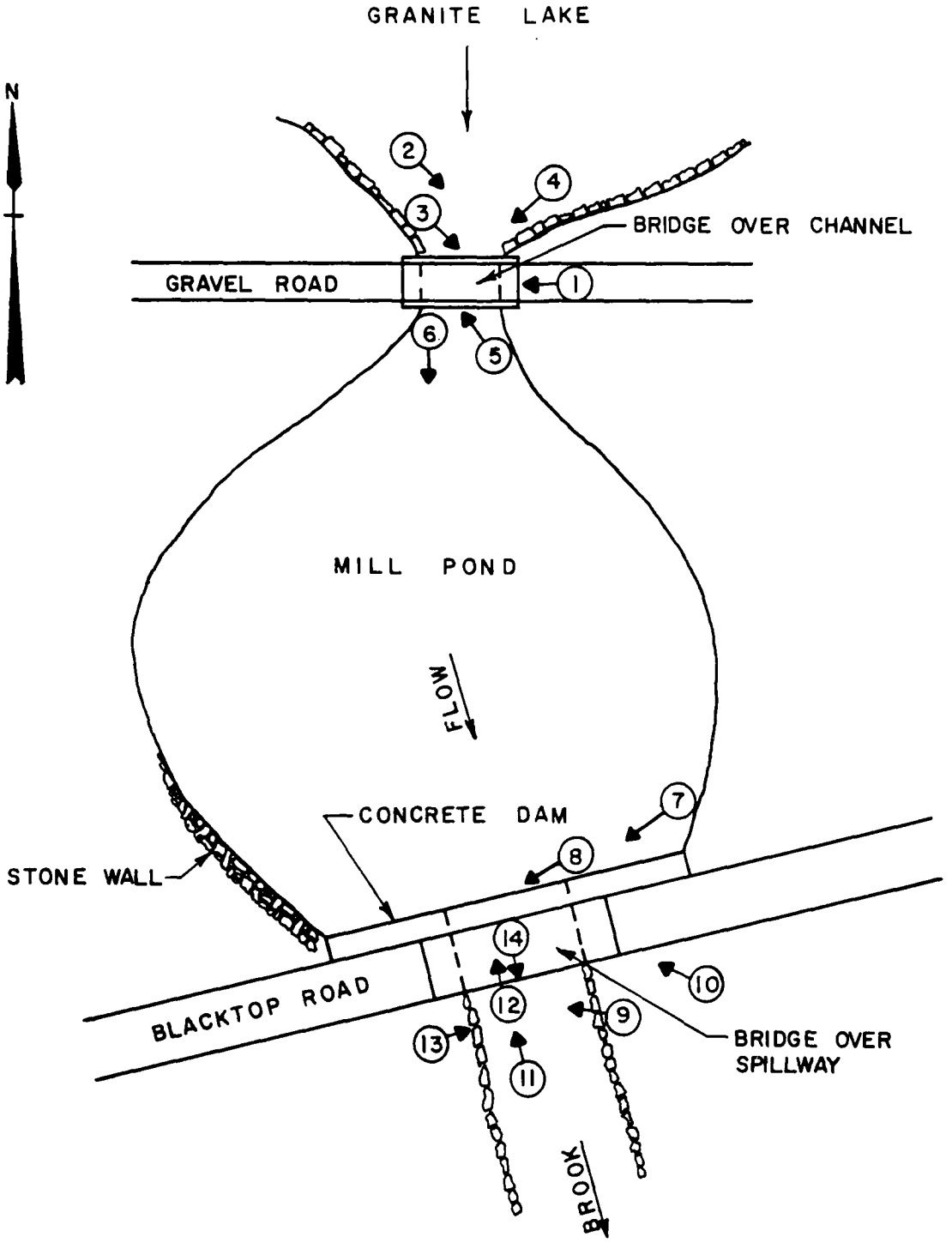

TWIN HILLS
Brooks Hill Elev 1600
Dakin Hill Elev 1800
Nice View From Here
Public Service Company Transmission Line
STODDARD
Deer Crossing
Partridge
Camp Ground (Boy Scout Camp)
Around The Lake
Sandy Beach
Trout
Bass
Pickerel
Deep
111
Granite Lake
STODDARD
NELSON
TOWN LINE
Concord
Pierce Highway
Franklin
Munsonville NH
Keene
Route 9
GRANITE LAKE
Length
Greatest Width
Length of Shore Line
Area
Altitude 1281 ft
Greatest Depth 111 ft
Figures indicate measured depths
Contour intervals 6 ft. approximate
Key To Homes and Cottages
2 Meth Church
4- Mason
5- Old Mill
6- MacBean
15- Dutton
18-Holt
19- Swan
20- Eames
23- Green
24- Weaver
25- McIntire
27- Table
28 Caffin
30 Knight
31- Jackson
32- Hackler
33- Case
35- Fisher
36- Poland
38- Gibson
39- Dutton
40- Fisher
41- Steinhardt
42- MacKechnie
43- White
44- Mason
46- Jackson
53 Barr
54- Balou
55 Wright
56- Sebastian
57- Brown
58- Dinsmore
59- Forsgen
61- Kirk
62- Wright
63- Jackson
64- Wichland
65- Hill
66- Elliott
67- Vararest
WILLIAM W McINTIRE '46

APPENDIX C

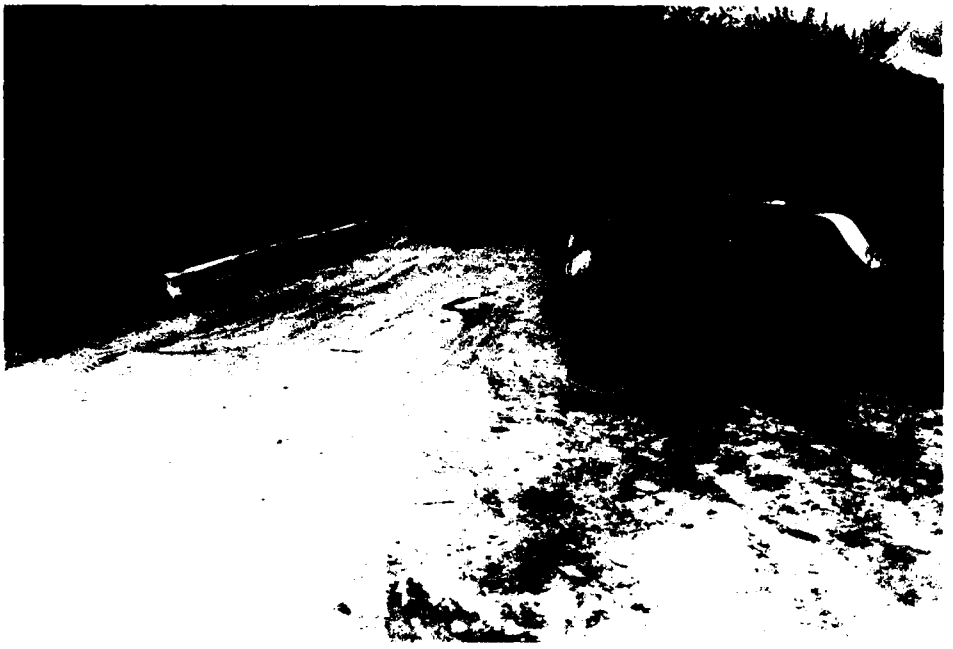
PHOTOGRAPHS

APPENDIX C

REPRESENTATIVE PHOTOGRAPHS OF PROJECT



GRANITE LAKE DAM
LOCATION OF PHOTOGRAPHS



1. Bridge Over Approach Channel from Granite Lake to the Mill Pond, Looking West.

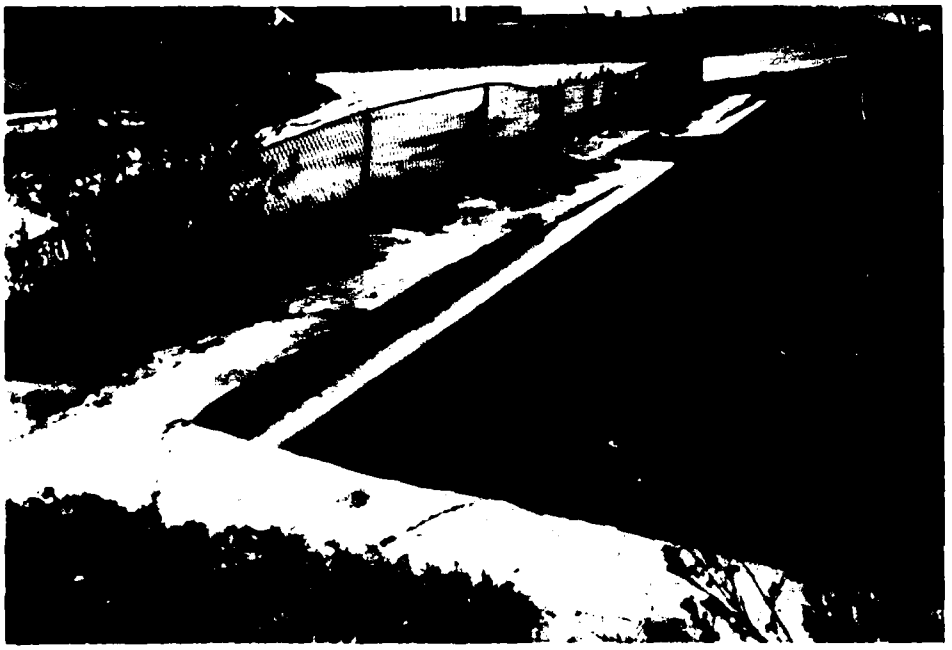
2. Same Bridge looking from the South Top of the [illegible]

3. Close-up View of the Channel from Granite Lake to Mill Pond, Looking South.

4. West Abutment of the Bridge Over the Approach Channel, Looking from Granite Lake

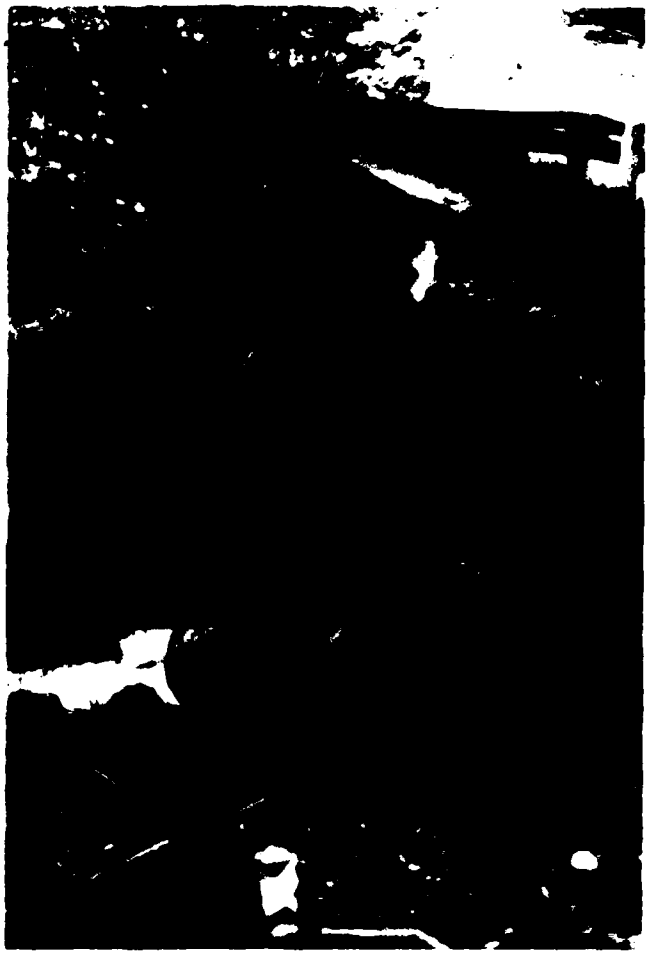
5. Bridge Over Approach Channel Looking from the Mill Pond Side and Showing the Condition of the East Abutment.

6. Mill Pond Looking South, with the Dam at the Left.



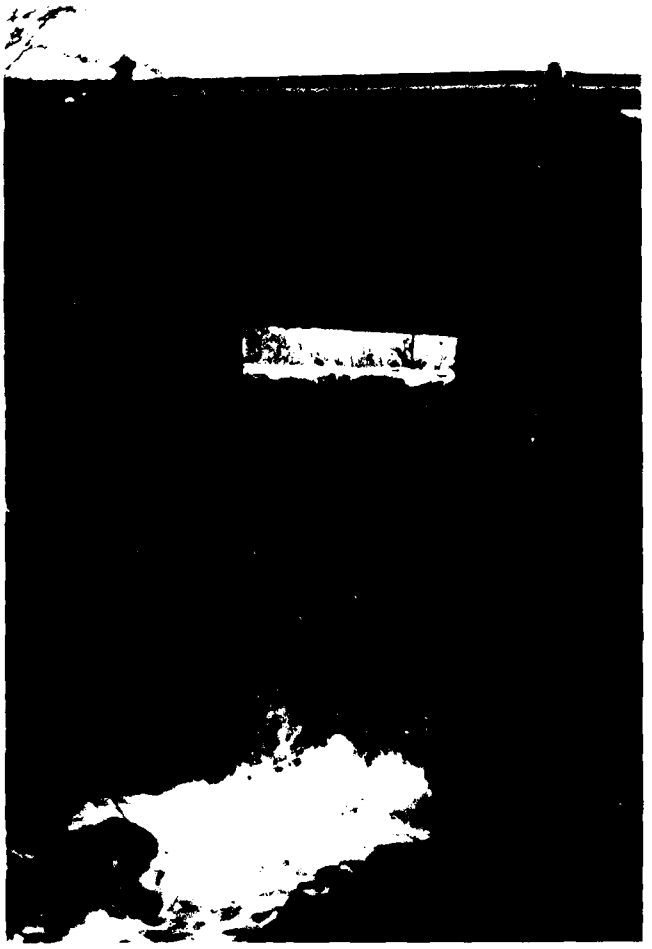
7. The Dam on the Mill Pond Side, Looking West.

6. Spillway Crest at the West Abutment.



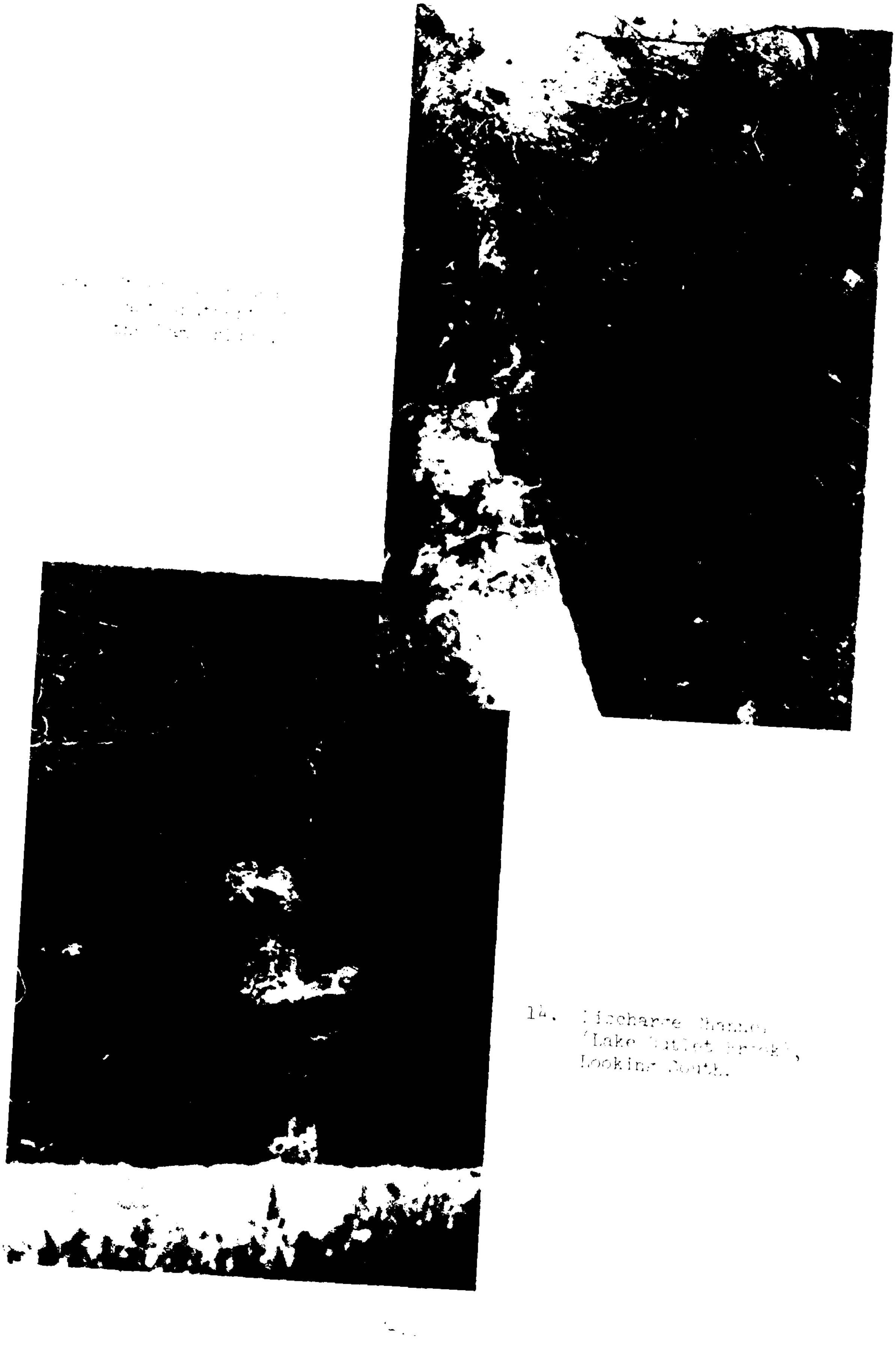
9. Bridge Over the Dam, Looking West.

. . Erosion of Material Under the Bridge at East Abutment.



11. Spillway and Discharge Channel Under the Bridge, Looking Upstream.

12. Close-up of the Spillway Under the Bridge.



14. Discharge Channel (Lake Outlet Brook), Looking South.

APPENDIX D

HYDROLOGIC & HYDRAULIC COMPUTATIONS

FAY, SPOFFORD & THORNDIKE, INC
ENGINEERS
BOSTON

PROJECT EN-006(9)

FILE NUMBER EN-006
SHEET NUMBER 1
DATE 6/3/79
COMPUTED BY H.H.S.
CHECKED BY

SUBJECT National Dam Insp. PROGRAM
Granite Lake Dam

Drainage area of Granite Lake Dam = 3.78 sq miles

The drainage area of Granite Lake Dam is characterized by rolling topography. Hence from guide curves furnished by the Corps of Engineers it is found that

Probable Maximum Flood Peak Inflow = 1950 x 3.70
= 7215 C.F.S

According to size classification, Granite Lake Dam is intermediate in size

According to hazard classification it falls under category of significant hazard potential

∴ Adopted Spillway Test Flood Peak Inflow
= 1/2 Probable Maximum Flood = 3608 C.F.S

Area of Granite Lake Dam is approximately 211.8 Acres

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BOSTON

PROJECT EN-006(9)

FILE NUMBER EN-006
SHEET NUMBER 14A
DATE 6/7/79
COMPUTED BY H.H.S.
CHECKED BY

JECT Granite Lake Dam
o Determine Peak Outflow

Trial #6

From the composite rating curve, the above Outflow Peak Rate corresponds to elev. 1285.3

i.e. Surcharge height above the Spillway Crest
= 5.8 feet

∴ Vol of Surcharge Storage (Stor$_1$)

$$= \frac{230 \times 5.8}{3.7 \times 640} \times 12$$

= 6.76 inches of runoff From D.A.

∴ Peak Outflow $Q_{p_2} = 3103\left(1 - \frac{6.76}{9.5}\right)$

$Q_{p_2} = 3103(1 - .711)$

$Q_{p_2} = 3103 \times .289$

$Q_{p_2} = 897$ CFS.

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BOSTON

PROJECT EN-006(9)

FILE NUMBER EN-006
SHEET NUMBER 14
DATE 6/7/79
COMPUTED BY H.H.S.
CHECKED BY

OBJECT Granite Lake Dam
To Determine Peak Outflow

Trial #5

From the composite rating curve, the above Outflow Peak Rate corresponds to elev. 1283.9

i.e. Surcharge Heigh above Spillway Crest
= 4.4 Feet

∴ Vol of Surcharge Storage (Stor,)

$$= \frac{230 \times 4.4}{3.7 \times 640} \times 12$$

= 5.128 inches of runoff from D.A.

∴ Peak Outflow $Q_{p_2} = 3103\left(1 - \frac{5.128}{9.5}\right)$

$= 3103\,(1 - .539)$
$= 3103 \times .461$
$= 1430$ CFS

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PROJECT EN-006(9)

FILE NUMBER EN-006
SHEET NUMBER 13
DATE 6/7/79
COMPUTED BY H.H.S.
CHECKED BY

SUBJECT Granite Lake Dam
To Determine Peak Outflow

Trial #4

From the composite rating curve, the above Outflow Peak Rate corresponds to elev. 1286.2

i.e. Surcharge height above the Spillway Crest
= 6.7 Feet

∴ Vol of Surcharge Storage (Stor,)

$$= \frac{230 \times 6.7}{3.7 \times 640} \times 12$$

= 7.809 inches of runoff from D.A.

∴ Peak Outflow $Q_{P_2} = 3103\left(1 - \frac{7.809}{9.5}\right)$

$Q_{P_2} = 3103(1 - .822)$
$= 3103 \times .178$
$= 553$ cfs

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BOSTON

PROJECT EN-006(9)

FILE NUMBER EN-006
SHEET NUMBER 12
DATE 6/7/79
COMPUTED BY H.H.S.
CHECKED BY

SUBJECT Granite Lake Dam
To Determine Peak Outflow

Trial #3

From the composite rating curve, the above Outflow Peak Rate corresponds to elev. 1262.1

i.e. Surcharge height above the Spillway Crest
= 2.6 Feet

∴ Volume of Surcharge Storage (Stor,)

$$= \frac{230 \times 2.6}{3.70 \times 640} \times 12$$

= 3.03 inches of runoff From D.A.

∴ Peak Outflow $Q_{P_2} = 3103\left(1 - \frac{3.03}{9.5}\right)$

$Q_{P_2} = 3103(1 - .318)$
$= 3103 \times .682$
$= 2116$ CFS

Trial = 2:

From the Composite rating curve, the above Outflow Peak Rate corresponds to elev. 1207.3

i.e. Surcharge Height above Spillway Crest
= 7.8 feet

∴ Vol of Surcharge Storage ($Stor_1$)

$$= \frac{230 \times 7.8}{3.7 \times 640} \times 12$$

= 9.091 inches of runoff from D.A.

∴ Peak Outflow $Q_{P_2} = Q_{P_1}\left(1 - \frac{Stor_1}{9.5}\right)$

$$= 3103\left(1 - \frac{9.091}{9.5}\right)$$

$$= 3103\,(1 - .956$$

$$= 3103 \times .044$$

$$= 137 \text{ CFS}$$

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ENGINEERS
BOSTON

PROJECT EN-006(9)

FILE NUMBER EN-006
SHEET NUMBER 10
DATE 6/7/79
COMPUTED BY H.H.S
CHECKED BY

SUBJECT Granite Lake Dam
To Determine Peak Outflow

Spillway Test Flood Peak Inflow (Q_{P_1})
= 3608.0 C.F.S.

Trial #1:

Assume inflow volume = 0.5" of runoff from D.A.

Available Surcharge Storage up to top of dam

$$= \frac{2.30 \times 2.5}{3.7 \times 6.40} \times 12$$

= 2.913 inches of runoff from D.A

$$\frac{\text{Lake Surcharge Storage}}{\text{Inflow Runoff Volume}} = \frac{2.913}{0.5} = .306$$

Referring to Figure 17-11 in SCS NEH, Section 4

$$\frac{\text{Outflow Peak Rate}}{\text{Inflow Peak Rate}} = 0.86$$

∴ Outflow Peak Rate = 0.86 × 3608 = 3103 cfs

FAY, SPOFFORD & THORNDIKE, INC. ENGINEERS BOSTON

PROJECT EN-006(9)

FILE NUMBER EN006
SHEET NUMBER 9
DATE 6/8/79
COMPUTED BY H.H.S
CHECKED BY

SUBJECT Granite Lake Dam

Estimation of Discharge Through Outlet Works

A. Discharge Through Penstock (32" Diameter)

(1) W.S.L. in Lake at elev 1279.5

$$Q_{pen} = 0.63 \times \frac{\pi}{4} \times \left(\frac{32}{12}\right)^2 \times \sqrt{29} \times \sqrt{6.37}$$

$$= 0.63 \times \frac{\pi}{4} \times 7.11 \times 8.02 \times 2.640$$

$$= 75 \text{ CFS}$$

(2) W.S.L in Lake at elev 1282.0

$$Q_{pen} = 0.63 \times \frac{\pi}{4} \times 7.11 \times 8.02 \times \sqrt{9.47}$$

$$Q_{pen} = 87 \text{ CFS}$$

(3) W.S.L in Lake at max pool level = 1284.8

$$Q_{pen} = 0.63 \times \frac{\pi}{4} \times 7.11 \times 8.02 \times \sqrt{12.27}$$

$$Q_{pen} = 99 \text{ CFS}$$

B. Discharge Through Drain (18" Diameter)

(1) W.S.L. in Lake at elev 1279.5

$$Q_{drain} = 0.63 \times \frac{\pi}{4} \times \left(\frac{18}{12}\right)^2 \times \sqrt{29} \times \sqrt{7.25}$$

$$= 0.63 \times \frac{\pi}{4} \times 2.25 \times 8.02 \times 2.692$$

$$= 24 \text{ CFS}$$

(2) W.S.L in Lake at elev 1282.0

$$Q_{drain} = 0.63 \frac{\pi}{4} \times 2.25 \times 8.02 \times \sqrt{9.75}$$

$$Q_{drain} = 28 \text{ CFS}$$

(3) W.S.L in Lake at max pool level = 1284.8

$$Q_{drain} = 0.63 \frac{\pi}{4} \times 2.25 \times 8.02 \times \sqrt{12.55}$$

$$Q_{drain} = 32 \text{ CFS}.$$

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BOSTON

PROJECT EN-006 (9)

FILE NUMBER [illegible]
SHEET NUMBER 6 OF
DATE 7-1-71
COMPUTED BY [illegible]
CHECKED BY

SUBJECT GRANITE LAKE DAM

ESTIMATION OF CAPACITY CURVE FOR GRANITE LAKE

SPILLWAY CREST ELEVATION = 1279.5

SURFACE AREA OF LAKE AT EL. 1279.5
= 211.8 acres

ELEVATION	LAKE VOLUME
1279.5	2204.0 acre-feet
1280.0	2319.0 "
1280.5	2434.0 "
1281.0	2549.0 "
1281.5	2664.0 "
1282.0	2779.0 "
1285.5	3475.0 "
1288.5	4110.0 "
1289.5	4322.0 "

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BOSTON

PROJECT EN-006(9)

FILE NUMBER EN-C
SHEET NUMBER 2 OF
DATE
COMPUTED BY LGH
CHECKED BY

SUBJECT GRANITE LAKE DAM

COMPOSITE DISCHARGE RATING CURVE FOR SPILLWAY AND DAM FOR PULL LEVELS ABOVE TOP OF DAM.

H_1 (ft)	ELEV.	Q (cfs)
0	1279.5	0
0.5	1280.0	12.73
1.0	1280.5	36.00
1.5	1281.0	66.00
2.0	1281.5	102.00
2.5	1282.0	142.30 ←
3.25	1282.75	211.00
3.50	1283.00	269.00 ←
4.00	1283.50	380.00
4.50	1284.00	504.00
5.00	1284.50	881.00
5.50	1285.00	1199.00
6.50	1286.00	1748.00
8.50	1288.00	3799.00
10.00	1289.50	5534.00

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PROJECT EN-001(9)

FILE NUMBER EN-2[illegible]
SHEET NUMBER 6 OF
DATE 2-12-[illegible]
COMPUTED BY [illegible]
CHECKED BY

SUBJECT GRANITE LAKE DAM

COMPOSITE DISCHARGE RATING CURVE FOR SPILLWAY AND DAM FOR POOL LEVELS ABOVE TOP OF DAM.

$H_{13} = 8.5$ $\quad Q_{13} = 3 \times 12 \times (8.5)^{3/2} + 2.6 \times 100 \times (5.0)^{3/2}$

$= 892 + 2907.0$

$= 3799.0$ CFS.

$H_{14} = 10.0$ $\quad Q_{14} = 3 \times 12 \times (10.5)^{3/2} + 2.6 \times 100 \times (6.5)^{3/2}$

$= 1225 + 4309$

$= 5534.0$ CFS.

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PROJECT EN-006(4)

FILE NUMBER EN-006
SHEET NUMBER 5 OF
DATE 2-12-1962
COMPUTED BY JBM
CHECKED BY

SUBJECT GRANITE LAKE DAM

COMPOSITE DISCHARGE RATING CURVE FOR SPILLWAY AND DAM FOR POOL LEVELS ABOVE DAM ELEVATION OF TOP OF DAM = 1282.0

$H_6 = 3.25$ $\quad Q_6 = 3.0 \times 12 \times (3.5)^{3/2}$

$= 211.0$ CFS

$H_7 = 3.50$ $\quad Q_7 = 3 \times 12 \times (3.50)^{3/2} + 2.6 \times 100 \times (2.5)^{3/2}$

$= 236 + 32.5$

$= 269$ CFS.

$H_8 = 4.0$ $\quad Q_8 = 3 \times 12 \times (4.0)^{3/2} + 2.6 \times 100 \times (0.5)^{3/2}$

$= 288 + 92.0$

$= 340.0$ CFS.

$H_9 = 4.5$ $\quad Q_9 = 3 \times 12 \times (4.5)^{3/2} + 2.6 \times 100 \times (1)^{3/2}$

$= 344 + 260$

$= 604$ CFS.

$H_{10} = 5.0$ $\quad Q_{10} = 3 \times 12 \times (5.0)^{3/2} + 2.6 \times 100 \times (1.5)^{3/2}$

$= 403 + 478$

$= 881$ CFS.

$H_{11} = 5.5$ $\quad Q_{11} = 3 \times 12 \times (5.5)^{3/2} + 2.6 \times 100 \times (2.0)^{3/2}$

$= 464 + 735.0$

$= 1199.0$

$H_{12} = 6.5$ $\quad Q_{12} = 3 \times 12 \times (6.5)^{3/2} + 2.6 \times 100 \times (3.0)^{3/2}$

$= 597 + 1351$

$= 1948$ CFS.

$(H_{12})_S = 8.3$ $\quad (Q_{12})_S = 3 \times 12 \times (8.3)^{3/2} =$ 2760 CFS.

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PROJECT EN-006(7)

FILE NUMBER [illegible]
SHEET NUMBER 4 OF
DATE 2-15-72
COMPUTED BY VRM
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SUBJECT GRANITE LAKE DAM

SPILLWAY DISCHARGE RATING CURVE

LENGTH = 12.0 feet

$C_d = 3.0$

$H_1 = 0.5$ $\quad Q_1 = 3.0 \times 12 \times (0.5)^{3/2} = 12.73$ CFS

$H_2 = 1.0$ $\quad Q_2 = 3.0 \times 12 \times (1.0)^{3/2} = 36.00$ "

$H_3 = 1.5$ $\quad Q_3 = 3.0 \times 12 \times (1.5)^{3/2} = 66.00$ "

$H_4 = 2.0$ $\quad Q_4 = 3.0 \times 12 \times (2.0)^{3/2} = 102.00$ "

$H_5 = 2.5$ $\quad Q_5 = 3.0 \times 12 \times (2.5)^{3/2} = 142.30$ "

SPILLWAY CREST ELEV. 1279.5

ELEVATION	Q (CFS)
1279.5	0
1280.0	12.73
1280.5	36.00
1281.0	66.00
1281.5	102.00
1282.0	142.30

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BOSTON

PROJECT EN-[illegible] (7)

FILE NUMBER [illegible]
SHEET NUMBER 3 [illegible]
DATE [illegible]
COMPUTED BY [illegible]
CHECKED BY [illegible]

SUBJECT GRANITE LAKE DAM

SPILLWAY TEST FLOOD PEAK INFLOW HYDROGRAPH
(BASED ON SCS DIMENSIONLESS UNIT HYDROGRAPH)

$T_c = 0.25$ hr.

$Q_p = 3608.0$ CFS.

T (HRS)	T/T_c	Q/Q_p	Q (CFS)
0.06	0.25	0.05	180.0
0.125	0.50	0.18	649.0
0.188	0.75	0.73	2634.0
0.250	1.00	1.00	3608.0
0.310	1.25	0.80	2886.0
0.375	1.50	0.40	1443.0
0.44	1.75	0.25	902.0
0.50	2.00	0.17	613.0
0.69	2.75	0.06	216.0
0.875	3.50	0.02	72.0
1.00	4.00	0.01	36.0

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ENGINEERS
BOSTON

PROJECT EN-C-1 (9)

FILE NUMBER
SHEET NUMBER
DATE
COMPUTED BY
CHECKED BY

SUBJECT

SPILLWAY TEST FLOOD INFLOW HYDROGRAPH
(BASED ON SCS DIMENSIONLESS UNIT HYDROGRAPH)

Max. length of travel = 5700 ft

Diff. in elevation = 540 ft.

$$t_c = \frac{(5700)^{1.15}}{7700 \times (540)^{0.38}} \text{ hrs.}$$

$$= \frac{20857}{7700 \times 11.29}$$

$$= 0.24 \text{ hr.}$$
$$= 0.25 \text{ hr.}$$

SPILLWAY TEST FLOOD PEAK INFLOW (Q_{PI})
$= 3608.0$ cfs.

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ENGINEERS
BOSTON

PROJECT EN-006(9)

FILE NUMBER EN-006
SHEET NUMBER 14B
DATE 6/7/79
COMPUTED BY H.H.S.
CHECKED BY

SUBJECT Granite Lake Dam
To Determine Peak Outflow

Trial # 7

From the composite rating curve, the above Outflow Peak Rate corresponds to elev. 1284.6

i.e. Surcharge height above the Spillway Crest
= 5.1'

∴ Vol of Surcharge Storage (Stor1)

$$= \frac{230 \times 5.1}{3.7\%640} \times 12$$

= 5.944 inches of runoff From D.A.

∴ Peak Outflow $q_{p_2} = 3103\left(1 - \frac{5.944}{9.5}\right)$

$q_{p_2} = 3103\,(1 - .625)$

$q_{p_2} = 3103 \times .375$

$q_{p_2} = 1164$ CFS.

Trial #8

From the composite rating curve, the above Outflow Peak Rate corresponds to elev. 1284.9

i.e. Surcharge height above the Spillway Crest
= 5.4'

∴ Vol of Surcharge Storage (Stor$_1$)

$$= \frac{230 \times 5.4}{3.7 \times 690} \times 12$$

= 6.293 inches of runoff from D.A.

∴ Peak Outflow $Qp_2 = 3103 \left(1 - \frac{6.293}{9.5}\right)$

$= 3103 (1 - .662)$
$= 3103 \times .338$
$= 1048$ CFS

Trial #9

From the composite rating curve, the above Outflow Peak Rate corresponds to elev. 1284.8

i.e. Surcharge height above the Spillway Crest
= 5.3

∴ Volume of Surcharge Storage ($Stor_1$)

$= \frac{230 \times 5.3}{3.7 \times 640} \times 12 =$

= 6.177 inches of runoff from D.A.

∴ Peak Outflow $Qp_2 = 3103\left(1 - \frac{6.177}{9.5}\right)$

$= 3103 (1 - .650)$
$= 3103 \times .350$
$= 1086$ CFS.

Average of $Stor_1$ and $Stor_2$

$= \frac{6.293 + 6.177}{2}$

= 6.24 inches of runoff from D.A

∴ Peak Outflow $= 3103\left(1 - \frac{6.24}{9.5}\right)$

$= 3103 (1 - .656)$
$= 3103 \times .344$
$= 1067$ CFS

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ENGINEERS
BOSTON

PROJECT EN-006(9)

FILE NUMBER EN-006
SHEET NUMBER 16
DATE 6/7/79
COMPUTED BY H.H.S.
CHECKED BY

SUBJECT Granite Lake Dam
To determine Peak Outflow

Peak Outflow of 1067 CFS corresponds to a maxium pool elev 1284.8

∴ Maximum Surcharge height = 5.3 Feet

Dam would be overtopped by 2.8 Feet

Spillway can pass with Lake water Surface at elev 1282 or at Top of dam = 142.0 CFS

Spillway can pass at maxium pool elev, 1284.8, 940 CFS

Spillway can pass about 13% of the Peak Outflow corresponding to Test Flood Adopted

Therefore the spillway is inadequate

FAY, SPOFFORD & THORNDIKE, INC
ENGINEERS
BOSTON

PROJECT EN-006 (9)

FILE NUMBER EN-006
SHEET NUMBER 17
DATE 11-20-1978
COMPUTED BY VRM.
CHECKED BY

SUBJECT GRANITE LAKE DAM

ESTIMATION OF DEPTH OF FLOOD WATER IN THE VICINITY OF DAMAGE IMPACT AREA DUE TO BREACH IN THE DAM AT RESERVOIR FULL CONDITION.

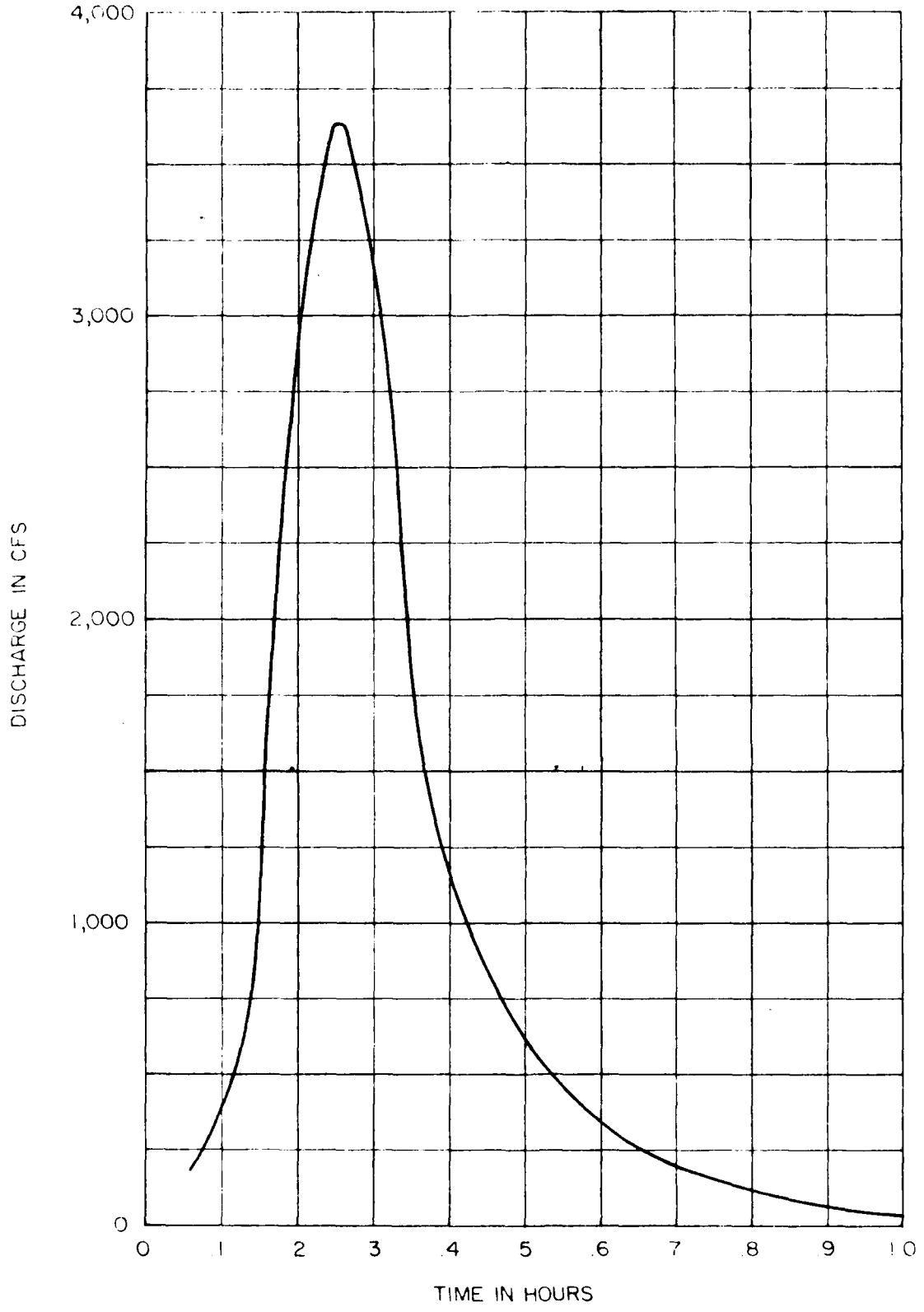
As explained in section 1.2d, it is not possible to generate downstream dam failure hydrograph in the vicinity of damage impact area, using USGS topo map on which the contours are at 20-feet intervals.

Besides, no other topographic map is available for the area.
From the knowledge of the damage impact area, in the vicinity of East Sullivan village which is at a distance of about 3 miles downstream from the dam, a ball park estimate has been made as follows:

Depth of water above the stream bed at F.R.L

$$= 1279.5 - 1267.5$$
$$= 12.0 \text{ feet.}$$

Height of flood wave at damage impact area is estimated to be about 8.0 feet.
Width of water spread at damage impact area is approximately indicated on the USGS map included in APPENDIX - D.



SPILLWAY TEST FLOOD INFLOW HYDROGRAPH

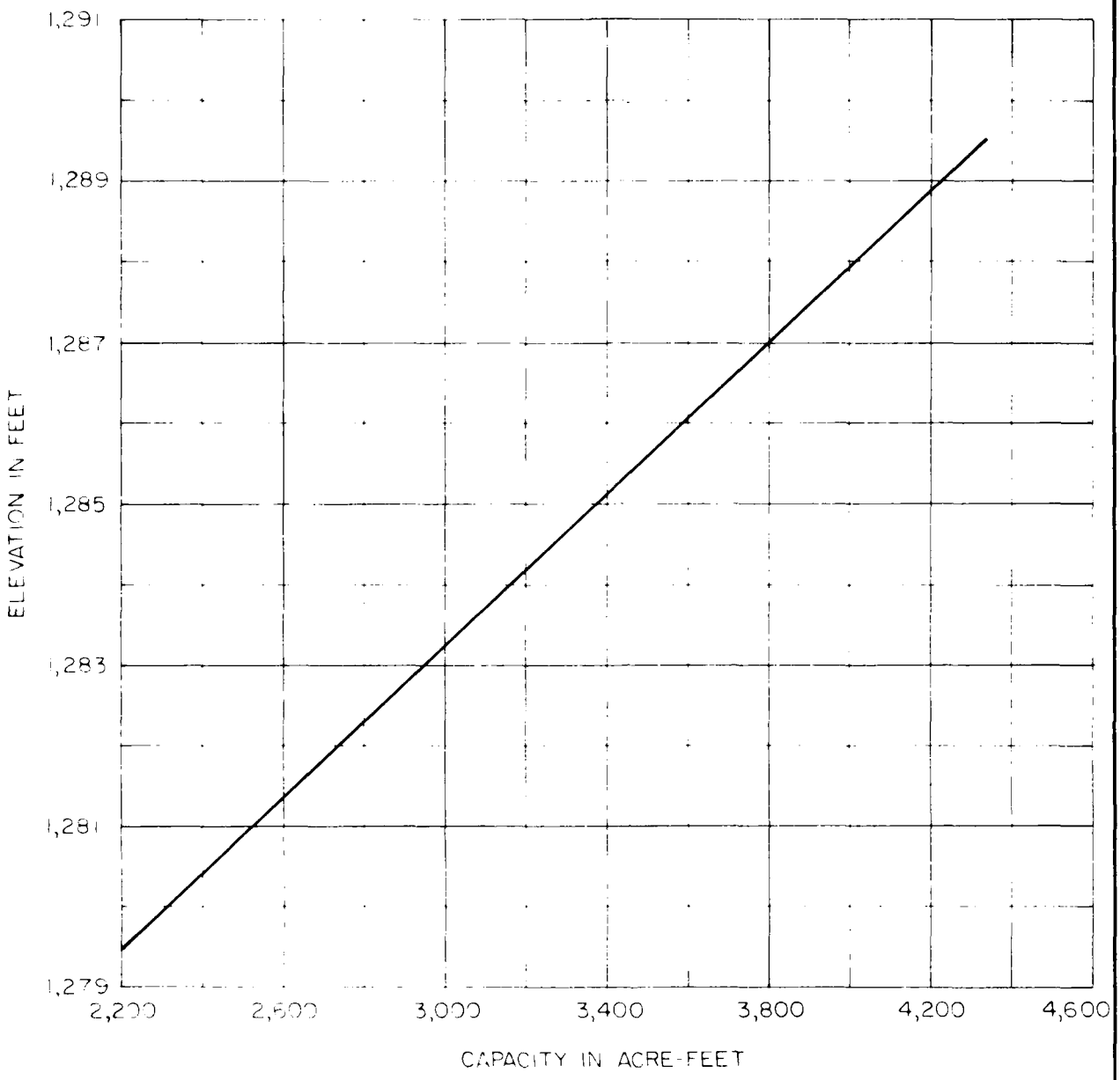
FAY, SPOFFORD & THORNDIKE, INC. ENGINEERS BOSTON, MASS.	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

GRANITE LAKE DAM

OTTER BROOK — NEW HAMPSHIRE

			SCALE AS SHOWN
			DATE AUGUST, 1978



STORAGE CAPACITY – ELEVATION CURVE

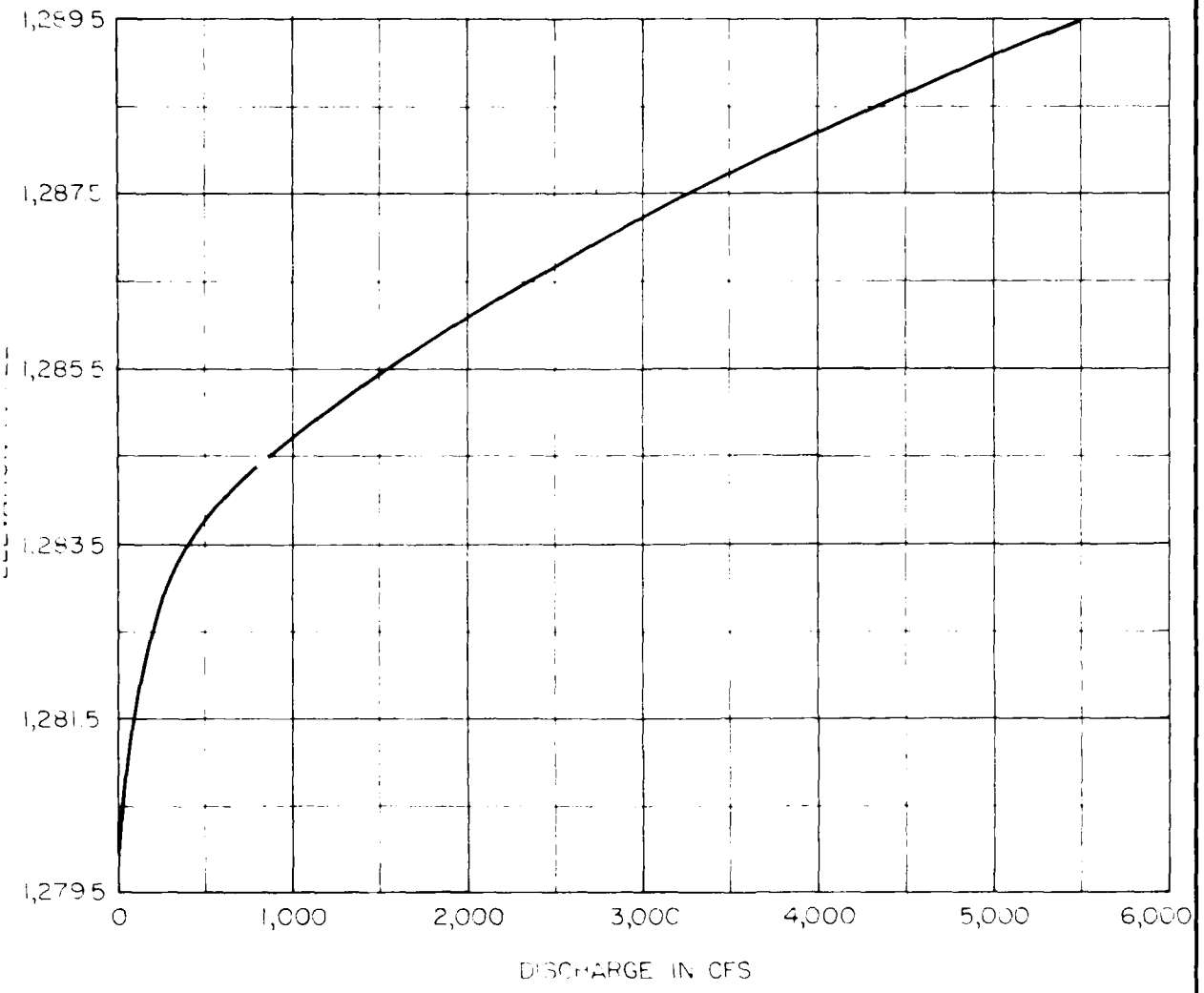
FAY, SPOFFORD & THORNDIKE, INC ENGINEERS BOSTON, MASS	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

GRANITE LAKE DAM

OTTER BROOK — NEW HAMPSHIRE

SCALE	AS SHOWN
DATE	AUGUST, 1978



RATING CURVE FOR SPILLWAY AND DAM

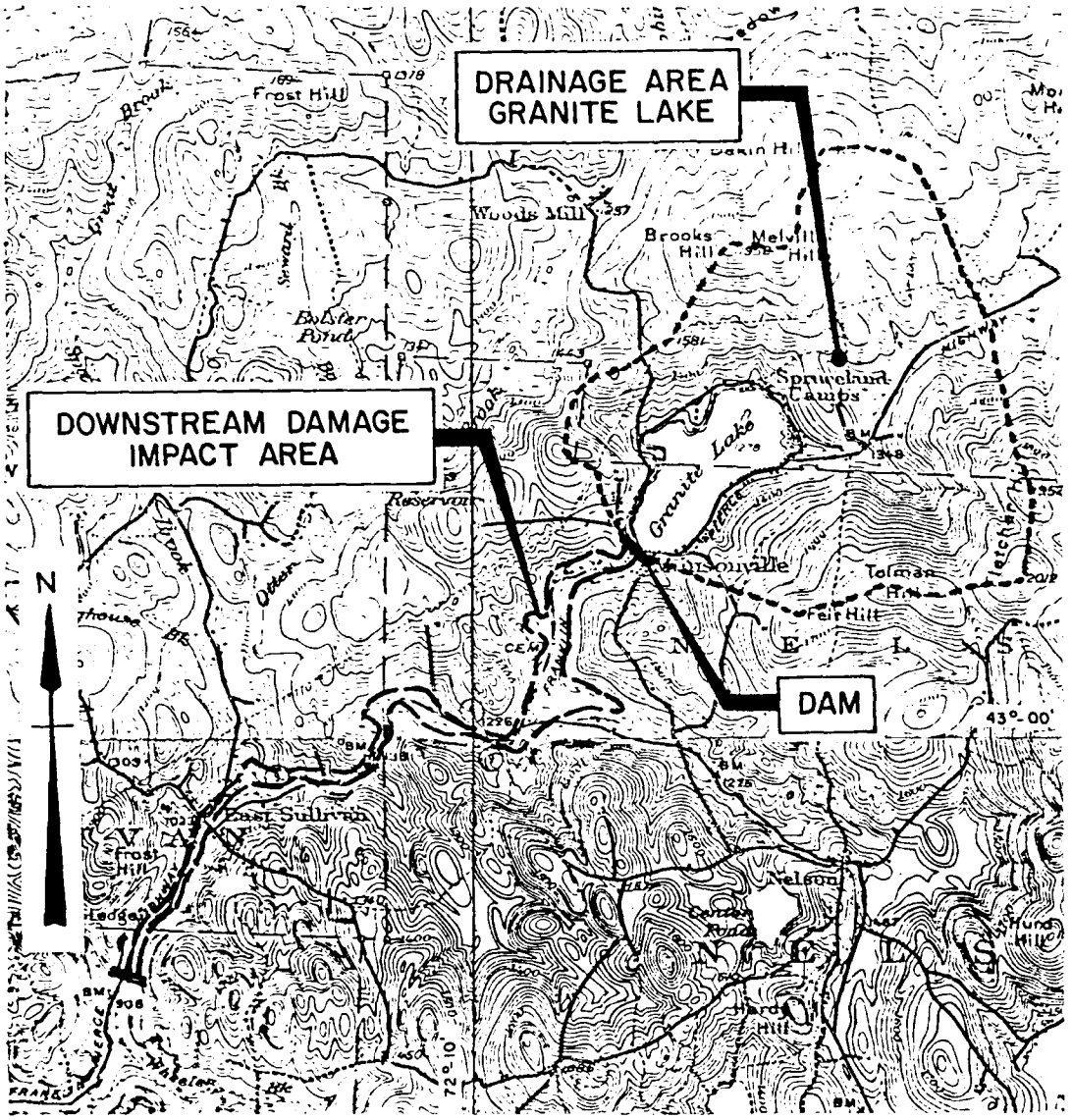
FAY, SPOFFORD & THORNDIKE, INC ENGINEERS BOSTON, MASS	U S ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

GRANITE LAKE DAM

OTTER BROOK NEW HAMPSHIRE

SCALE	AS SHOWN
DATE	AUGUST, 1978



SCALE 1:62500 (ACTUAL)

UNITED STATES
DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY

NEW HAMPSHIRE

MONADNOCK QUADRANGLE 1949
AMS 6569 I-SERIES V712

LOVEWELL MOUNTAIN QUADRANGLE 1957
AMS 6570 II-SERIES V712

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

NH	005	02	GRANITE LAKE DAM	4300.9	7208.9	31OCT78	

POPULAR NAME	NAME OF IMPOUNDMENT
	GRANITE LAKE

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	08	GRANITE LAKE BROOK	MUNSONVILLE	0	300

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
RACTPG	1932	R	15	14	1400	850	NED	N	N	N	N	15JAN79

REMARKS

D/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
2	78	U	12	142	1300											

OWNER	ENGINEERING BY	CONSTRUCTION BY
GRANITE LAKE ASSN		

REGULATORY AGENCY DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NH WATER RES BD	NH WATER RES BD	NH WATER RES BD	NH WATER RES BD

INSPECTION BY	INSPECTION DATE DAY MO YR	AUTHORITY FOR INSPECTION
FAY SPOFFORD + THORNDIKE, INC	25MAY78	PL92-367

REMARKS

END

FILMED

7-85

DTIC